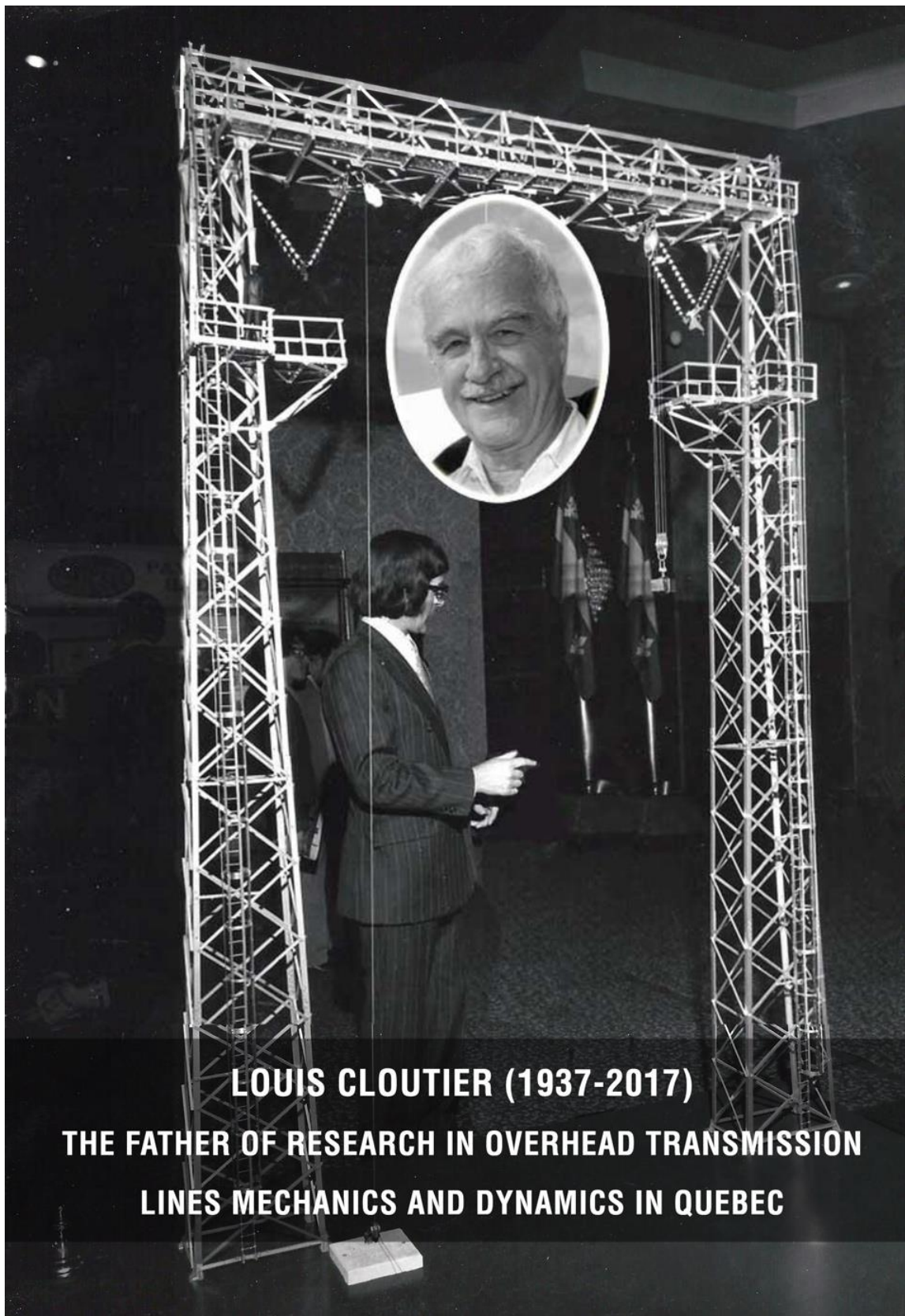




LOUIS CLOUTIER (1937-2017)

**THE FATHER OF RESEARCH IN OVERHEAD TRANSMISSION
LINES MECHANICS AND DYNAMICS IN QUEBEC**

LOUIS CLOUTIER (1937-2017)¹

**THE FATHER OF RESEARCH IN OVERHEAD TRANSMISSION
LINE MECHANICS AND DYNAMICS IN QUEBEC**

by : Claude Hardy, Eng., Ph.D.

March 2017

Introduction

When Louis Cloutier joined IREQ² in the late 1960s, Hydro-Québec was in the midst of planning for its James Bay complex. In the case of overhead power transmission lines, a voltage of 1000 kV or more was considered, which would have required the use of six or eight conductor bundles rather than the traditional four-conductor bundles already used at 735 KV, in order to satisfy the environmental criteria (audible noise and corona effect) in addition to reducing the number of lines required. Nothing was known at that time about the vibratory behaviour of these multiple conductor bundles under the influence of the wind. Already a rather unknown vibratory phenomenon had appeared on existing lines using four-conductor bundles and it had proved problematical. This phenomenon, first called subspan oscillations, revealed to be one of the modes of an aeroelastic instability phenomenon which manifest themselves under the action of wind when one or several sub- conductors of the bundle lie in the immediate wake of one or more sub-conductors located upstream.

Research groups ³

It is in this context that Louis Cloutier, in close association with the engineers of the Hydro-Québec "Service Études et Normalisation" launched the first research program in the Americas specifically focused on this phenomenon of oscillations of conductor bundles under the effect of wind. This was to mark the beginning of an exciting and fruitful adventure for dozens of researchers, engineers and technicians from Quebec.

¹ The cover page shows Louis Cloutier under the model of a tower of the future Magdalen Islands Test Line. In medallion, Louis 40 years later.

² IREQ : Institut de Recherche d'Hydro-Québec (Hydro-Québec research division)

³ It should be noted that other people have done research in mechanics and dynamic of overhead lines in Quebec during the period covered here, including Ghyslaine McClure at McGill University.

The aim of this first program was to understand the phenomenon, to identify all the factors contributing to it, to measure and predict their intensity and consequences and to recommend preventive measures.

Among other Louis' initiatives, this IREQ / HQ nascent research team joined forces with a team of the National Research Council's Aerodynamics Laboratory to carry out studies on two-dimensional models of suspended conductor bundles mounted in a subsonic wind tunnel.

It was also decided at that time to establish a full scale test line, in a natural environment, well-instrumented and with a continuous presence of observers, which was established in the Magdalen Islands because of the abundance of high winds over there.

At the end of 1974, Louis left the IREQ team, now led by the author of these lines. That team was to gradually broaden its field of research to cover the entire spectrum of conductor vibrations, i.e. wake-induced oscillations of bundled conductors, Aeolian vibrations of conductors used in solo as well as in a bundle and to a lesser extent galloping. In doing so, it was necessary to open up to several subfields such as wind power transmitted to the conductors in various modes of Aeolian vibrations as well as self-damping and fatigue of the stranded conductors.

For his part, Louis then joined Roctest Ltd, where he was quick to launch the development of a device to perform the digitized measurement of Aeolian vibrations of conductors on live lines as well as the logging and storage of data, all *in situ*. Among other innovations, the TVM-90 recorder used a revolutionary measurement method being simply clamped to the conductor rather than being inconveniently attached under the suspension clamps in order to measure the amplitude of bending locally at the clamp exit.

Later, in 1983, after joining the Department of Mechanical Engineering at Laval University, Louis again launched another research project in collaboration with IREQ, one devoted to the fatigue of stranded electric conductors. This led to the formation of a group, together with Professors Alain Cardou and Sylvain Goudreau, eventually called GREMCA ("Groupe de Recherche sur la Mécanique des Conducteurs Aériens"), dedicated as the name suggests to the entire mechanics of overhead conductors. This group has been active until recently. It must be said that Louis never lost interest in the subject afterwards even though he occupied the leading roles of department head and dean of the Faculty of Science and Engineering.

Later in the late 1980s, the IREQ / HQ group teamed up with a team from the Aerodynamics Laboratory of the Department of Mechanical Engineering at the Université de Sherbrooke, led by Professor André Laneville, to conduct wind tunnel studies in relation to Aeolian vibrations of single conductors as well as bundled ones.

Lastly, in 2004, Louis was to become the first holder of the NSERC Hydro-Québec TransÉnergie Chair on electric power transmission lines, located at the Université de Sherbrooke. He would be succeeded by Professor Frédéric Légeron and, later, by Professor Sébastien Langlois, with the Chair being successively renamed Chair and Group Hydro-Québec / RTE (Electricity Transmission Network) on structures and mechanics of power lines, its mandate remaining practically the same. Here, the beneficial partnership between Hydro-Québec and RTE of France in the financing of this group should be highlighted

The Nature of Research

All these groups and teams devoted themselves to research and development of any kind, be it theoretical research, modeling, experimental research in both indoor and outdoor laboratories, in particular measurement of stranded conductors self-damping, laboratory and field evaluation of conductor vibration and oscillation control systems and fatigue tests of these conductors. Finally, with the help of industrial partners, they will undertake the development of anti-vibration devices and methods of application of these devices.

This chapter could include the assessment of performance of commercial anti-vibration systems under established protocols.

Specialized laboratories

The aforementioned research has led to the design and construction of several specialized laboratories, including:

- The Magdalen Islands Test Line (Figs E-1 and E-2 in Appendix E), mentioned above, which was in continuous operation from 1973 to 1993.
- The Varennes Test Line (Fig. I-3), commissioned in 1993 and still in operation actually.
- The indoor conductor self-damping test bench at IREQ.
- The conductor fatigue test benches at Laval University (Fig. 4-E).

Establishing and operating such laboratories as these test lines in a natural environment, equipped with dozens of sensors of all kinds, represented a colossal challenge. It should be noted here that up to now, they are among the rare such facilities in the world not to have become "white elephants", which says a lot about the determination, dedication and perseverance of the people who imagined, defended, implemented and operated them.

Achievements

Achievements resulting from research carried out under Louis Cloutier's initiatives are countless. First to be mentioned is the highly specialized training offered by the department of Mechanical Engineering of University Laval and the departments of Mechanical Engineering and Civil Engineering of University of Sherbrooke which led concretely to several PhD and master's theses. In many cases, IREQ contributed to the training of these young researchers in addition to their owns.

With respect to physical products, one should not forget the development of Hydro-Québec/IREQ's star product, the quad spacer-damper (Figure E-5), along with the development of its protocol of use on lines, followed by the adaptation of this technology to double and triple spacer-dampers. Initially used in the late 1970s, these anti-vibration devices now equip Hydro-Québec's high-voltage lines by hundreds of thousands. When one adds the spacers sold and installed elsewhere in Canada, but also in Argentina, India, Bangladesh, the United Kingdom, Peru, United States and China, one is certainly close to a million. Importantly, this has resulted in the creation of several dozen jobs in Quebec.

One should also add the development of the PAVICA recorder (Fig. 6-E) by IREQ, a lighter and improved instrument for the measurement and analysis of Aeolian vibrations *in situ*. Succeeding the TVM-90 mentioned above, this device has been manufactured and marketed by the Quebec firm Roctest Ltd. It has been sold and used in more than 25 countries around the world.

On the same topic, mention should be made of the development of Hydro-Québec vibration dampers, a product using the same patented articulation technology as the spacer-dampers, which are now an integral part of all new Hydro-Québec transmission lines, as well as the old ones when they are upgraded. These dampers are also used elsewhere on several other lines.

At this point, we would like to highlight the contribution of several Quebec SMEs in the development, manufacture and marketing of all these anti-vibration devices, such as FL Electromechanics, PEFCO, Lyster Die Casting, Eastern Die Cast and Hélix Uniformé. Abroad, Dynalab (Argentina), TAG Corp. (India) and Dulmison (UK). The relationship with these industries has gone well beyond the simple customer-supplier relationship often taking the form of a true partnership.

Large-scale test programs for foreign companies include an extensive evaluation of spacer-dampers at the Magdalen Islands Test Line in 1981/82. These tests were performed on a continuous basis during a six months period, on behalf of the Argentine company Hidronor for use on a 750 kV line to link Patagonia to Buenos Aires.

On the same experimental line, an eight-month continuous study was conducted on behalf of American Electric Power in order to determine the wind-induced

vibrational behavior of a 12-conductor bundle (Figs. E-7 and E-8) planned for power transmission at 1200-1500 kV.

There are too many spin-offs to mention all, but we cannot ignore the valuable support provided by several researchers and engineers to Quebec consulting engineering firms thanks to their expertise acquired in the various research projects carried out.

Publications ⁴

Not the least of the achievements, the publications of these various groups and research teams number in the hundreds. They are listed in Appendices A, B, C and D, depending on whether they emanated from the IREQ/Hydro-Québec, GREMCA, Mechanical Engineering (Université de Sherbrooke) teams or the HQ/RTE Chair. In each of these lists, they are grouped together according to whether they relate to books, articles in scientific and technical journals, conference articles, reports, theses and dissertations.

Among other leading publications is the famous "Orange Book", a book published by the American research granting agency Electrical Power Research Institute (EPRI), generally regarded as the "bible" in the field. Entitled: "EPRI Transmission Line Reference Book: Wind-Induced Conductor Motion. Second edition ", it was written by several co-authors in the following way:

- G. Diana, U. Cosmai, **A. Laneville**, A. Manenti D. Hearnshaw, K. Papailiou, Chapter 2: "Aeolian Vibration", 158 p.
- **L. Cloutier, S. Goudreau, A. Cardou**, Chapter 3: " Fatigue of Overhead Conductors ", 56 p.
- JL Lillien, D. Havard, **P. Van Dyke**, Chapter 4: " Galloping Conductors ", 130 p.
- **C. Hardy, M. St. Louis**, U. Cosmai, C. Rawlins, Chapter 5: "Bundle Conductor Oscillations", 79 p.
- J. Wang, C. Pon, T. Gillepsie, Chapter 6. "Overhead Fiber Optic Cables", 40 p.
- A. Goel, **M. Farzaneh**, D. Havard, **F. Legeron**, JL Lillien, J. Wang, Chapter 7: " Other Motions ", 64 p.

It should be noted that the 21 co-authors are of at least six different nationalities, but most of all, nine were Quebecers or New-Quebecers, all of whom had been involved in the research teams mentioned above.

As part of the dissemination of knowledge, mention should be made of the tutorials relating to the work of CIGRE Working Group B2.11. These are listed in Appendix F. It will be noted that of the 41 tutorials presented until March 2014, 21

dealt with subjects studied in working groups chaired either by Louis Cloutier or by the author of these lines, namely:

- The survey on the state of the art regarding spacers and spacer dampers.
- The fatigue endurance of conductor-clamp systems.
- The safe design tension of overhead conductors with respect to Aeolian vibrations

This unequivocally underlines the interest shown everywhere for these subjects developed within CIGRE under impetus of Quebecers.

Involvement in special technical committees

Participation of Quebec researchers and engineers in national and international technical committees is widely acknowledged. This involvement began with Louis at the national level in the former Working Group CEA E&O (*Canadian Electrical Association, Engineering & Operating*). It continued at the national level by the commitment of the author of these lines for a dozen years in the former Working Group "CEA R&D Conductor Dynamics" through which several funded research projects have been defined and granted to two of the aforementioned teams.

As regards IEEE, mention should be made of the active involvement of both Louis and the author of these lines in a committee which came up with a revised standard for the measurement of on-line Aeolian vibrations: IEEE Standard 1368-2006, "IEEE Guide for Aeolian Vibration Field Measurements of Overhead Conductors", June 6.

But it was certainly within CIGRE that Louis was the most diligent. It should be noted that he acted as leader for three Task Forces, namely:

- TF B2.11.05, "State-of-the-Art Survey on Spacers and Spacer-Dampers"
- TF B2.11.07, "Fatigue Endurance Capability of Conductor/Clamp Systems - Update of Present Knowledge"
- WG B2.30, "Engineering Guidelines Relating to Fatigue Endurance Capability of Conductor/Clamp Systems"

Each time, the work was crowned either by an article published in *Electra* or by a thematic brochure according to the new CIGRE policy.

We find Louis also as an active member of several CIGRE subgroups related to Working Group "B2.11 - *Mechanical Behavior of Conductors and Accessories*." In each group, either in collaboration with him or otherwise, one finds a number of Quebecers, including André Laneville, Sébastien Langlois, André Leblond,

Frédéric Légeron, Simon Prud'homme, Michel St-Louis, Jean-Philippe Paradis, Pierre Van Dyke as well as the author of these lines.

Distinctions

In terms of distinctions, let's first point out that Louis was named Eminent Member of CIGRE in 2006, a title given to long-standing members for their loyalty and their contribution to the technical work of the Association.

It should also be noted that in 1990 the IREQ / HQ team was honored as a recipient of the MICA-Research Award from the Quebec Electronics Industry Council for the development of the PAVICA device, which arose, it should be recalled, from the TVM-90 device, whose development had been launched by Louis while working at Roctest Ltd.

It should also be noted that this same expanded team was the recipient of Hydro-Québec's "Reconnaissance Quart de siècle" Award for the 25th anniversary of IREQ in 1995 for all of their work in R & D aimed at controlling wind-induced vibrations of overhead lines.

Also worthy of mention is this very tangible sign of interest on the part of the members of the Study Committee B2 of CIGRÉ "Overhead Lines" with regard to the publications of Task Force B2.11.07 "Safe Conductor Design Tension with Respect To Aeolian Vibrations"; a group of which Louis was a member and which the author of these lines had the privilege of leading. A 2010 survey of SC B2 members revealed that the resulting Electra article and the corresponding thematic brochure on the subject were respectively the first out of seven and the third out of ten of the most mentioned.

Conclusion

How to conclude this text without paying tribute, unfortunately posthumously, to our friend Louis Cloutier, the undisputed pioneer and most active promoter of research in the mechanics and dynamics of power transmission lines in Quebec. Thanks to its many initiatives, starting with the launch of the first research team in this field at IREQ in the late 1960s, followed by the launch of a team that was to become GREMCA at Université Laval and finally by taking charge of the Chair at the Université de Sherbrooke, he has enabled us to advance science and technology considerably in our field and he has led us to the highest levels, both nationally and internationally.

At the same time, Louis would have certainly liked it, why not pay tribute to ourselves whether we are or have been researchers, engineers, technicians, student-researchers or manufacturers associated with one or other of the components of this vast network which, thanks to our determination, talent and efforts, have been together with him the artisans of this great success.

Besides, one of the finest compliments that has been given to us was by the late, great Chuck Rawlins, who said he often drew inspiration from our work to lead his own.

A thousand thanks Louis! Rest in peace and be proud of what you have accomplished, because we all are!

Acknowledgements

The author would like to thank professors Alain Cardou and Sylvain Goudreau from Laval University, professors André Laneville and Sébastien Langlois from the Université de Sherbrooke and Dr André Leblond from Hydro-Québec TransÉnergie for graciously providing the required information for the drafting of this document. He would also like to convey his gratitude to both Dr André Leblond and Michel St-Louis, a retired engineer from Hydro-Québec, for their careful review. A great thank you also to professor Alain Cardou for having in addition undertaken the translation of this document to English.

⁴ Note that these directories are not necessarily exhaustive on the one hand and some publications can be found in more than one on the other.

APPENDIX A
IREQ / HYDRO-QUÉBEC
DIRECTORY OF PUBLICATIONS
DIRECTORY OF BOOKS

1. Lilien, J.L., D. Havard and P. Van Dyke, 2009 ‘Galloping Conductors, Chapter 3 of EPRI Transmission Line Reference Book: "Wind-Induced Conductor Motion: Second Edition". EPRI. Palo Alto, CA. 140 p.
2. Hardy, C. M. St-Louis, U. Cosmai and C. Rawlins, 2009, "Bundle Conductor Oscillations", Chapter 4 of EPRI Transmission Line Reference Book: Wind-Induced Conductor Motion: Second Edition. EPRI. Palo Alto, CA. 79 p.
3. Farzaneh, M., Volat C., and Leblond, A., 2008, "Atmospheric Icing of Power Networks”, Chapter 6 “Anti-icing and De-icing Techniques for Overhead Lines”, ISBN 978-1-4020-8530-7, M. Farzaneh, ed., 40 p.
4. Leblond, A. and Lindsey, K.E., 2014, "Overhead Lines", CIGRE Green Book, Chapter 16 “Maintenance”, ISBN 978-2-85873-284-5, 42 p.

DIRECTORY OF SCIENTIFIC AND TECHNICAL PAPERS

1. Cardou, A., Leblond, A. and Cloutier, L., 1993, “Suspension Clamp and ACSR Electrical Conductor Contact Conditions”, *J. Energy Engrg., ASCE*, 119(1), April, pp. 19-31.
2. CIGRÉ Task Force B2.11.01, 1998, (G. Diana convenor + several co-authors including C. Hardy and L. Cloutier), “Modelling of Aeolian Vibrations of a Single Conductor plus Damper: Assessment of the Technology”, *Electra* No. 181, December, pp. 52-69.
3. CIGRÉ Task Force 22.11.04, 1999, (C. Hardy convenor + several co-authors including L. Cloutier), “Safe Design Tension with Respect to Aeolian Vibrations. Part 1: Single Unprotected Conductors”, *Electra* No. 186, October. pp. 52-67.
4. CIGRÉ Task Force 22.11.03, 2000, (T. Smart convenor + several co-authors including M. St-Louis), "Guide to Fittings for Optical Cables on Transmission Lines. Part 2A-Testing Procedures. Optical Ground Wire Fittings and Optical Phase Conductor Fittings", *Electra* No. 188, February, pp. 43-53.

5. CIGRÉ Working Group 22.11, 2000, (M. Wolf convenor + several co-authors including M. St-Louis and P. Van Dyke), "Review of Galloping Control Methods", Electra No. 191, August, pp. 45-61.
6. CIGRÉ Task Force 22.11.04, 2001, (C. Hardy convenor + several co-authors including A. Leblond and L. Cloutier), "Safe Design Tension with Respect to Aeolian Vibrations. Part 2: Damped Single Conductors", Electra No. 198, October pp. 28-43.
7. CIGRÉ Working Group B2.31, 2003, (L.J. Cloutier convenor + several co-authors including M. St-Louis) "State of the Art Survey on Spacers and Spacer Dampers", Electra No. 209, August, pp. 14-27.
8. CIGRÉ Task Force 22.11.04, 2005, (C. Hardy convenor + several co-authors including A. Leblond and L. Cloutier), "Overhead Conductor Safe Design Tension with Respect to Aeolian Vibrations. Part 3: Bundled Conductor Lines", Electra No. 220, June pp. 48-59.
9. CIGRÉ Task Force B2.11.01, 2005, (G. Diana convenor + several co-authors including C. Hardy, A. Leblond, A. Laneville and L. Cloutier), "Modelling of Aeolian Vibrations of a Single Conductor plus Damper: Assessment of the Technology", Electra No. 223, December, pp. 28-36.
10. CIGRÉ Working Group B2.31, 2011, (G. Diana convenor; + several co-authors including A. Leblond, C. Hardy, L. Cloutier and A. Laneville) "Modelling of Aeolian Vibration of Single Conductors Strung at Relatively High Tensile Load. Application to HV & UHV Lines", Electra No. 256, June, pp. 34-40.
11. CIGRÉ Working Group B2.46, 2015, (G. Diana convenor; + several co-authors including A. Leblond, J. P. Paradis, C. Hardy, and P. Van Dyke) "Wind-Induced Conductor Motions on Bundled Conductors (Excluding Galloping). Part A- Aeolian Vibrations. Part B-Subspan Oscillations", CIGRÉ Science & Engineering, N°2, June, pp. 46-62.
12. Hardy, C. & P. Bourdon, 1980, "The Influence of Spacer Dynamic Properties in the Control of Bundle Conductor Motion", IEEE Transactions on Power Apparatus and Systems, Vol. PAS-99, N° 2, pp. 790-99.
13. Hardy, C. & P. Van Dyke, 1995, "Field Observations on Wind-Induced Conductor Motions", Journal of Fluids and Structures, Vol. 9, pp. 43-60.
14. Hardy, C., Noiseux, D., Leblond, A., Brunelle, J. & Van Dyke, P., 1996, "Modelling of Single Conductor-Damper System Response", Contract No. 372T823, Canadian Electricity Association, July.
15. Foata, M. et Noiseux, D., 1991 "Computer Analysis of the Effects of Asymmetries of a Two Conductor Bundle upon its Aeolian Vibration", IEEE Transactions on Power Delivery, volume 6, no 3, 1991, p. 1132–1138.

16. M. Iordanescu, C. Hardy & J. Nourry, 1987, "Structural Analysis and Testing of HV Busbar Assemblies with Rigid Conductors under Short-Circuit Conditions", IEEE Trans. on Power Delivery, Vol. PWRD-2, No. 4, Oct.
17. Lanteigne, J. (1985) Theoretical estimation of the response of helically armored cables to tension, torsion, and bending. Transactions of the ASME, Journal of Applied Mechanics, volume 52, no 2, pp. 423–32.
18. Leblond, A., L. Cloutier, C. Hardy & L. Cheng, 1995, "A Model on Self-Damping of Stranded Cables in Random Transverse Vibrations", Canadian Acoustics, 23(3), pp. 31-32.
19. Leblond, A. & C. Hardy, 2005 "Unifying Calculation of Vortex-Induced Vibration of Overhead Conductors", Journal of Wind and Structures, Vol. 8, No. 2, pp. 79-88.
20. D.U. Noiseux, C. Hardy & S. Houle, 1987, "Statistical Methods Applied to Aeolian Vibrations of Conductors", Journal of Sound and Vibration, Vol. 113(2), 8 March, 245-255 (1987).
21. Noiseux, D. U., Houle, S. et Beauchemin, R. (1988), "Transformation of Wind Tunnel Data on Aeolian Vibrations for Application to Random Conductor Vibrations in a Turbulent Wind, IEEE Transactions on Power Delivery, Volume 3, no 1, p. 265–271.
22. Noiseux, D. U. (1992) "Similarity Laws of the Internal Damping of Stranded Cables in Transverse Vibrations". IEEE Transactions on Power Delivery, Volume 7, no 3, p. 1574–1581.
23. M. St-Louis, C. Hardy, J.-P. Bellerive et J.-G. Gagné, 1990, "Les Entretoises pour Faisceaux multiples : l'Expérience d'Hydro-Québec", Revue Générale de l'Électricité, No. 11, décembre, pp. 52-59.
24. Tsui, Y.T., 1975, "Two-Dimensional Stability Analysis of a Circular Conductor in the Vicinity of Another", IEEE Paper A75-576-9.
25. P. Van Dyke, C. Hardy, M. St-Louis & J.L. Gardes, 1997, "Comparative Field Tests of Various Practices for the Control of Wind-Induced Conductor Motion", IEEE Transactions on Power Delivery, Vol. 12, No. 2. April 1997.

DIRECTORY OF CONFERENCE PAPERS

1. Angelini, J., C. Hardy, M. Gaudry, & E. Ghannoum 1998, "Increasing the Ampacity of Overhead Lines Using Homogeneous Compact Conductors", Power Delivery Europe Conference, London, U.K., 27-29 Oct.
2. Bourdon, P., J. Brunelle & C. Hardy, 1985, "Dynamic Characteristics of

Transmission Line Dampers and Spacer-Dampers", Canadian Electrical Association Conductor Vibration Workshop, March 1985, Montréal.

3. Bourdon, P., J. Brunelle & C. Hardy 1986, "The Application of Experimental Modal Analysis to Transmission Line Hardware", 4th International Modal Analysis Conf., Los Angeles, CA, February.
4. Bourdon, P., P. Van Dyke & C. Hardy 1993, "Field Tests of the Vibration Characteristics of Two Types of OPGW", CEA Eng. & Oper. Division Meeting, Montréal, 28 March-2 April.
5. Bourdon, P., J. Brunelle & C. Hardy, 1986, "The Application of Experimental Modal Analysis to Transmission Line Hardware", 4th International Modal Analysis Conf., Los Angeles, CA, February 1986.
6. Cardou, A., Leblond, A., Goudreau, S. and Cloutier, L., 1993, "Overhead Electrical Conductors Bending Fatigue at Suspension Clamps: A Fretting Fatigue Problem", *Int'l Conf. Fretting Fatigue*, Sheffield, U.K., 19-22 April.
7. Cardou, A., C. Dalpé & C. Hardy 1997, "Fretting Fatigue of the Drake ACSR Electrical Conductor under Cyclic Bending at Suspension Clamp", Proceedings of the International Symposium on Fretting, Chengdu, China, 13-16 Nov.
8. Cloutier, L.J., C. Hardy & J. Brunelle 1974, "The Magdalene Islands Test Line: a Research Tool for the Studies of Bundle Conductor Dynamics", IEEE Summer Power Meeting, Paper n° C74 370-3, Anaheim, California.
9. Cloutier, L.J., J. Brunelle & C. Hardy 1979, "Enregistreur de vibrations pour lignes de transport", Can. Congress of Applied Mechanics, Mai 1979, Sherbrooke.
10. Cloutier, L.J., C. Dalpé, A. Cardou, C. Hardy & S. Goudreau, 1999, "Studies of Conductor Vibration Fatigue Test, Flexural Stiffness and Fretting Behaviour", Proceedings of the Third International Symposium on Cable Dynamics, Trondheim, Norway, 17-19 August, pp.197-202.
11. Foata, M., C. Hardy, M. St-Louis & J. Brunelle, 1988, "Modelling of Conductor Vibrations and Application to the Grondines 450 kV River Crossing", CEA Eng. & Oper. Div. Transactions, Vol. 28 (1988/1989).
12. Goudreau, S., Jolicoeur, C., Cardou, A., Cloutier, L. & Leblond, A., 2003, "Palmgren-Miner Law Application to Overhead Conductor Fatigue Prediction", *Proc. of the 5th Int. Symposium on Cable Dynamics*, 15-18 September, Santa Margherita Ligure (Italy), pp. 501-508.
13. Hardy, C. & P. Bourdon, 1979, "The Influence of Spacer Dynamic Properties in the Control of Bundle Conductor Motion", IEEE/PES Summer Meeting, Paper n° F79 733-7, Vancouver, C.-B., July.

14. Hardy, C, A. Watts, J. Brunelle & L.-J. Cloutier, 1975, "Research on the Dynamics of Bundled Conductors at the Hydro-Québec Institute of Research", CEA Engineering & Operating Division Transactions, Vol. 14, Part 4.
15. Hardy, C, L.J. Cloutier & J. Brunelle, 1981, "A Novel Approach to Aeolian Vibration Measurement", Canadian Electrical Association International Symposium on Overhead Conductor Dynamics, Toronto, June.
16. Hardy, C, "Research and Development in the Field of HV Transmission Lines at Hydro-Québec", 1982 Conference of the Power Engineer Association, C.E.A., New Delhi, India, 9 March.
17. Hardy, C, 1984, "Hydro-Québec's Method for Evaluating the Performance of Spacer-Damper Systems with Respect to Control of Subspan Oscillations and Aeolian Vibrations". URSS - Hydro-Québec Symposium on Recent Developments in EHV and UHV Transmission Lines, Montréal, November.
18. Hardy, C, 1990, "Analysis of Self-Damping Characteristics of Stranded Cables in Transverse Vibrations", Proc. of the CSME, Mechanical Engineering Forum 1990, Vol. 1: Fluid Mechanics, Mechanical Engineering, Education, Thermal Systems, University of Toronto, June 3-9, pp. 117-122.
19. Hardy, C & J. Brunelle, 1991, "Principles of Measurement and Analysis with the New PAVICA Conductor Vibration Recorder", Canadian Electrical Association Centennial Conference, Toronto, May.
20. Hardy, C & P. Van Dyke, 1992, "Field Observations on Wind-Induced Conductor Motions", ASME International Symposium on Flow-Induced Vibrations & Noise, Anaheim, California, 8-13 November, pp.113-129.
21. Hardy, C & P. Van Dyke, 1992, "Field Observations on Wind-Induced Conductor Motions", CEA Eng. & Oper. Transactions, Vol. 32, 1992/93.
22. Hardy, C, P. Van Dyke, R. Dansereau, Y. Blanchette & J.-G. Gagné, 1995, "Hydro-Québec's Experience with Anti-Galloping Pendulums", CEA Electricity'95 Conference, Vancouver, 26-30 March.
23. Hardy, C, D. Noiseux, J. Brunelle, A. Leblond & P. Van Dyke, 1995, "Modelling of Single-Conductor-Damper System Response", CEA Electricity'95 Conference, Vancouver, 26-30 March.
24. Hardy, C, A. Leblond, S. Goudreau & L. Cloutier, 1995, "Review of Models of Self-Damping of Stranded Cables in Transvers Vibrations", Proc. of the International Symposium on Cable Dynamics, Liege, Belgium, October 19-21, pp. 61-68.
25. Hardy, C, J. Brunelle, J. Chevalier, B. Manoukian & R. Villandré, 1996, "Telemonitoring of Climatic Loads on Hydro-Québec 735 kV Lines", 7th International Workshop on Atmospheric Icing of Structures, Université du Québec à

Chicoutimi, Québec, 3-7 June.

26. Hardy, C, "Research on Homogeneous Compact Conductors", 1997, Conf. Électricité '97 de l'Association canadienne de l'électricité, Vancouver, 20-24 April.
27. Hardy, C, "Compact Conductors Expand Power Line Ampacity", 1997, IEEE Power Engineering Review, Oct., pp. 28.
28. Hardy, C, J. Brunelle, Y. Beauséjour, R. Lanoie, J.N. Laflamme & J.P. Bellerive, 1998, "Monitoring the Effects of Environmental Factors on Hydro-Québec's Overhead Lines", CIGRE SC22 Main Session, Paris, August.
29. Hardy, C, M. Gaudry, F. Chore & E. Ghannoum, "Increasing the Ampacity of Overhead Lines Using Homogeneous Compact Conductors", 1998, CIGRE SC22 General Session, Paris, August 1998.
30. Hardy, C, A. Leblond, S. Goudreau & L. Cloutier, 1999, "Application of Contact Mechanics to Cable Self-Damping", Proceedings of the Third International Symposium on Cable Dynamics, Trondheim, Norway, 17-19 August, pp. 1-6.
31. Hardy, C, 1999, "Hydro-Québec R&D Project on All-Aluminum-Alloy Compact Conductors", 1999, CIGRÉ Study Committee 22, Annual Meeting, Sydney, Australia, November.
32. Hardy, C & A. Leblond, 2001, "Statistical Analysis of Stranded Conductor Fatigue Endurance Data", Proceedings of the Fourth International Symposium on Cable Dynamics, Montreal, 28-30 May, pp. 195-202.
33. Hardy, C, 2002, "Ruminations about Overhead Line Reliability and Protection", CEA Technologies Inc., Workshop on Ice Storm Mitigation, Montreal, October 6-8.
34. Hardy, C & A. Leblond, 2003, "On the Dynamic Flexural Rigidity of Taut Stranded Cables", Proceedings of the Fifth International Symposium on Cable Dynamics, Santa Margherita Ligure (Italy), 15-18 September, pp.45-52.
35. Hardy, C, A. Leblond & D. Gagnon, 2005, "Theoretical Assessment of Ice Loading of Cables as a Function of their Torsional Stiffness", Proc. of the 11th International Workshop on Atmospheric Icing of Structures, Montreal, June 2005.
36. Hardy, C, 2005, Tutorial on "Conductor Safe Design Tension with Respect to Aeolian Vibrations" CIGRÉ SCB2 International Symposium on Overhead Line Innovations, Rio de Janeiro, Sept. 12. Also presented at the IEEE Towers, Poles and Conductors Subcommittee Meeting, Montreal, June 19, 2006.
37. Houle, S, C. Hardy, A. Lapointe & M. St-Louis, 1987, "Experimental Assessment of Spacer-Damper Performance With Regard to Control of Wind-Induced Vibrations of High Voltage Transmission Lines", IEEE/CSEE Joint Conference on High Voltage Transmission Systems in China, Beijing, China, 12-22 October.

38. Houle, S, C. Hardy, A. Lapointe & M. St-Louis, 1987, "Experimental Assessment of Spacer-Damper Performance With Regard to Control of Wind-Induced Vibrations of High Voltage Transmission Lines", IEEE Paper 87JC-39.
39. Houle, S, C. Hardy & E. Ghannoum, 1987, "Feasibility of Using Higher Conductor Tensions on ACSR Twin Bundles", CEA Engineering & Operating Division Transactions, Vol. 27 (1987/1988).
40. Houle, S, C. Hardy & E. Ghannoum, 1991, "Static and Dynamic Testing of Transmission Lines Subjected to Real Wind Conditions", CIGRE Symposium on Compacting Overhead Transmission Lines, Leningrad, 3-5 June.
41. Iordanescu, M., C. Hardy & J. Gagnon, 1984, "Analyse dynamique tridimensionnelle des structures de jeux de barres complexes en condition de court-circuit", Conférence internationale sur l'énergie et les communications, Montréal, Octobre.
42. Iordanescu, M., C. Hardy & J. Nourry, 1986, "Finite Element Analysis and Testing of Complex Busbar Structures under Short-Circuit Conditions", 4th Int. Modal Analysis Conference, Los Angeles, February.
43. Iordanescu, M., C. Hardy & J. Nourry, 1986, "Structural Analysis and Testing of HV Busbar Assemblies with Rigid Conductors under Short-Circuit Conditions", IEEE/PES 1986 Transmission and Distribution Conference, Anaheim, California, September 14-19.
44. Jahier, P., S. Houle, C. Hardy & E. Ghannoum, 1989, "Feasibility of Using Higher Conductor Tensions on ACSR Triple and Quad Bundles", CEA Eng. & Oper. Div. Trans., Vol. 29 (1989/90).
45. Leblond, A., Cloutier, L., Cardou, A. & C. Aubriot-Decoufour, 1995, "Conductor Self-Damping Measurements: A New Methodology Using Power Method", 15th Canadian Congress of Applied Mechanics, Victoria, 28 mai - 2 juin.
46. Leblond, A., L. Cloutier, C. Hardy & L. Cheng, 1995, "An Advanced Model Based on a Probabilistic Approach for Predicting Aeolian Vibrations of Single Overhead Conductors", Proc. of the International Symposium on Cable Dynamics, Liege, Belgium, October 19-21, pp. 281-288.
47. Leblond, A, L. Cloutier, C. Hardy & L. Cheng, 1996, "Model of Energy Imparted by Turbulent Wind to Overhead Conductors in Random Transverse Vibrations", Proc. of the Symposium on Mechanics in Design, CSME Forum, Toronto, May 6-9, pp. 247-256.
48. Leblond, A, L. Cloutier, C. Hardy & L. Cheng, 1996, "A Model of Suspension Clamp Rocking Action Due to Aeolian Vibrations of Overhead Conductors", Proc. of the 1996 ASME Pressure Vessels and Piping Conference, Flow-Induced Vibration, PVP-Vol. 328, Montréal, July 21-26, pp. 135-142.

49. Leblond, A, P. Van Dyke, L.P. Bibeau & C. Hardy, 1997, "Test Line Assessment of Mechanical Power Conveyed by Travelling Waves in Overhead Conductors", Comptes rendus du 16^{ième} Congrès canadien de mécanique appliquée, Université Laval, Québec, 1-5 juin, pp. 159-160.
50. Leblond, A & C. Hardy, 1997, "Extended Similarity Laws of Self-Damping for Multilayered Stranded Cables in Transverse Vibrations", Comptes rendus du 16^{ième} Congrès canadien de mécanique appliquée, Université Laval, Québec, 1-5 juin, pp. 155-156.
51. Leblond, A & C. Hardy, 1997, "A Relationship between Span Length Variation and Mechanical Tension in Catenary Cables", Comptes rendus du 16^{ième} Congrès canadien de mécanique appliquée, Université Laval, Québec, 1-5 juin, pp. 157-159.
52. Leblond, A, C. Hardy & J. Brunelle, 1997, "Probabilistic Model for Predicting Aeolian Vibration Response of Single Overhead Conductors", Proceedings of the 5th International Conference on Probabilistic Methods Applied to Power Systems, Sept. 21-25, pp. 323-328.
53. Leblond, A, C. Hardy, P. Van Dyke & L.P. Bibeau, 1997, "Field Assessment of the Efficiency of Conductor Damping Devices", Proceedings of the Second International Symposium on Cable Dynamics, Tokyo, 13 Oct., pp. 63-70.
54. Leblond, A, P. Van Dyke, L.P. Bibeau & C. Hardy, 1997, "Test Line Assessment of Mechanical Power Flow in Overhead Conductors and Efficiency of Damping Devices", Proceedings of the 4th International Symposium on Fluid-Structure Interactions, Aeroelasticity, Flow-Induced Vibration and Noise, Vol. I, Dallas, U.S.A., 16-21 Nov., pp. 169-176.
55. Leblond, A & C. Hardy, 1999, "On the Estimation of a 2x2 Complex Stiffness Matrix of Symmetric Stockbridge-Type Dampers", Proceedings of the Third International Symposium on Cable Dynamics, Trondheim, Norway, 17-19 August, pp. 139-144.
56. Leblond, A & C. Hardy, 2000, "Theoretical Assessment of the Complete Stiffness Matrix of Stockbridge-Type Dampers", *Proc. 9th International Conference on Pressure Vessel Technology*, Vol. 2, Sydney, Australia, 9-14 April, pp. 503-513.
57. Leblond, A & C. Hardy, 2000, "Assessment of Safe Design Tension with Regard to Aeolian Vibration of Single Overhead Conductors", Operation & Live-Line Maintenance Proceedings of the 2000 IEEE-ESMO 9th International Conference on Transmission & Distribution Construction, Montreal, 8-12 October, pp. 202-208.
58. Leblond, A & C. Hardy, 2001, "On the Computation of Safe Design Tension with Regard to Aeolian Vibration of Damped Single Overhead Conductors", Proceedings of the Fourth International Symposium on Cable Dynamics, Montreal, 28-30 May 2001, pp. 137-144.

59. Leblond, A., Montambault, S., St-Louis, M., Beauchemin, R., Laforte, J.-L. & Allaire, M.-A., 2002, "Development of New Ground Wire De-Icing Methods", *Proc. of the 10th Int. Workshop on Atmospheric Icing on Structures*, 17-20 June, Brno, Czech Republic.
60. Leblond, A., Gauthier, G., Gravel, S., Desbiens, R., Landry, D. & McClure, G., 2002, "Field Observations of Atmospheric Icing on a Test Distribution Line at Mont Bélair (Québec)", *Proc. of the 10th Int. Workshop on Atmospheric Icing on Structures*, Brno, Czech Republic, 17-20 June.
61. Leblond, A & C. Hardy, 2003, "A Unified Way for Presenting Aeolian Vibration Response of Single Undamped Overhead Conductors", *Proceedings of the Fifth International Symposium on Cable Dynamics*, Santa Margherita Ligure (Italy), 15-18 September, pp.263-270.
62. Leblond, A. & Côté, A., 2004, "Atmospheric Icing of OPGW: Monitoring and De-Icing", *Proc. of the Int'l OPGW Symposium*, Montréal, May 3-5.
63. Leblond, A., Lamarche, B., Bouchard, D., Panaroni, B. & Hamel, M., 2005, "Development of a Portable De-Icer Device for Overhead Ground Wires", *Proc. of the 11th Int. Workshop on Atmospheric Icing on Structures*, Montréal, Canada, June.
64. Leblond, A & C. Hardy, 2005, "Assessment of the Fretting-Fatigue-Inducing Stresses within Vibrating Stranded Conductors in the Vicinity of Clamps", *Proceedings of the Sixth International Symposium on Cable Dynamics*, Charleston, S.C., U.S.A., 19-22 Sept.
65. Leblond, A., Asano, Y. & Isozaki, M., 2009, "Performance Study of LC-Spiral Rods under Icing Conditions", *Proc. of the 13th Int. Workshop on Atmospheric Icing on Structures*, Andermatt, Switzerland, 8-11 Sept.
66. Leblond, A., Sugawara, N., Asano, Y. & Isozaki, I., 2011, "New Results on the Anti-Icing Performance of LC-Spiral Rods", *Proc. of the 14th Int. Workshop on Atmospheric Icing on Structures*, Chongqing, China, 8-13 May.
67. McClure, G. & Leblond, A., 1999, "Effets du verglas sur le comportement mécanique des lignes aériennes de transport et de distribution d'électricité", *67^e Congrès de l'ACFAS*, Ottawa, 12-13 mai.
68. Noiseux, D.U., S. Houle, R. Beauchemin, 1988, "Transformation of Wind Tunnel Data on Aeolian Vibrations for Application to Random Conductor Vibrations in a Turbulent Wind", *IEEE/PES 1998 Summer Meeting*, Mexico City.
69. Retallack, R.L. & P. Bourdon, 1981, "American Electric Power - UHV Bundle Conductor Tests at Magdalen Islands", *IEEE trans. on Power Apparatus and Systems*, Vol. PAS-100, Issue 12, Dec.

70. St-Louis, M. & C. Hardy, 1980, "Travaux récents d'Hydro-Québec en rapport avec les vibrations de ligne". Atelier de l'ACE sur le contrôle des vibrations des lignes de transport, Montréal, Mars.
71. St-Louis, M., C. Hardy, J.-P. Bellerive & J.-G. Gagné, 1993, "Bundled-Conductor Spacers: Hydro-Québec's Experience", CEA Eng. & Oper. Division Meeting, Montréal, 28 March-2 April.
72. Van Dyke, P., C. Hardy & M. St-Louis, 1991, "Comparative Field Vibration Tests on Single AAAC and ACSR Conductors", Canadian Electrical Association, E&O Meeting, Quebec City, October.
73. Van Dyke, P., C. Hardy & M. St-Louis, 1992, "Comparative Field Vibration Tests on Triple AAAC and Quad ACSR Bundled Conductors", Canadian Electrical Association, E&O Meeting, Vancouver, Canada, March.
74. Van Dyke, P., C. Hardy, M. St-Louis & J.L. Gardes, 1995, "Comparative Field Tests of Various Practices for the Control of Wind-Induced Bundled Conductor Motions", CEA Electricity'95 Conference, Vancouver, 26-30 March.
75. Van Dyke, P., & C. Hardy, 1996, "Effect of Wind Turbulence on Aeolian Vibrations of a Taut Cable", ASME-PVP-Flow-Induced Vibration Symposium, Montreal, 21 July.
76. Van Dyke, P., Hardy, C., St-Louis, M. & Gardes, J. L. (1996) Comparative field tests of various practices for the control of wind-induced conductor motion. Proceedings of Transmission and Distribution Conference and Exposition, New York, NY, USA, September 15-20, p. 346–351.
77. Volat, C., Farzaneh, M. & Leblond, A., 2005, "De-icing/Anti-icing Techniques for Power Lines: Current Methods and Future Direction", *Proc. of the 11th Int. Workshop on Atmospheric Icing on Structures*, Montréal, Canada, June.
78. Wardlaw, R.L., K.R. Cooper, R.G. Ko & J. A. Watts, 1974, "Wind Tunnel and Analytical Investigation into the Aeroelastic Behaviour of Bundled Conductors". *IEEE Transactions Paper T74* 368-7.

DIRECTORY OF SCIENTIFIC AND TECHNICAL REPORTS²

1. CIGRE Working Group B.11, 1994, (F. Tavano convenor + several co-authors including C. Hardy), "Conductor Self-Damping", CIGRE Report SC22-94(WG11)-126.
2. CIGRE Working Group B.11, 2004, (Several co-authors including C. Hardy, A. Leblond and L.J. Cloutier), "The Mechanical Behaviour of Conductors and Fittings", CIGRÉ Technical Brochure No. 25, August.

3. CIGRÉ Task Force B2.11.07, 2005, C. Hardy convenor + several co-authors including L.J. Cloutier and A. Leblond), "Overhead Safe Design Tension with Respect to Aeolian Vibrations", CIGRÉ Technical Brochure No. 273, June.
4. CIGRÉ Task Force B2.11.05, 2005, (L.J. Cloutier convenor + several co-authors including C. Hardy and P. Van Dyke), "State of the Art Survey on Spacers and Spacer-Dampers", CIGRÉ Technical Brochure No. 277, August.
5. CIGRÉ Task Force B2.16.03, 2006, (S. Fikke convenor + several co-authors including A. Leblond and C. Hardy), "Guidelines for Meteorological Icing Models, Statistical Methods and Topographical Effects", CIGRÉ Technical Brochure No. 291, April.
6. CIGRÉ Task Force B2.11.06, 2007, (J.L. Lilien convenor + several co-authors including P. Van Dyke, A. Laneville and M. St-Louis), "State of the Art on Conductor Galloping", CIGRÉ Technical Brochure No. 322, June.
7. CIGRÉ Task Force B2.11.07, 2007 (L.J. Cloutier convenor + several co-authors including A. Leblond and C. Hardy), "Fatigue Endurance Capability of Conductor/Clamp Systems – Update of Present Knowledge", CIGRÉ Technical Brochure No. 332, October.
8. CIGRÉ Working Group B2.30, 2010, (L.J. Cloutier convenor + several co-authors including C. Hardy and A. Leblond), "Engineering Guidelines Relating to Fatigue Endurance Capability of Conductor/Clamp Systems", CIGRÉ Technical Brochure No. 429, October.
9. CIGRÉ Working Group B2.29, 2010, (M. Farzeneh convenor + several co-authors including A. Leblond), "Systems for Prediction and Monitoring of Ice Shedding, Anti-Icing and De-Icing for Overhead Power Line Conductors and Ground Wires", CIGRÉ Technical Brochure 438, December.
10. CIGRÉ Working Group B2.25, 2011, (U. Cosmai convenor; C. Hardy and P. Van Dyke members), "State of the Art for Testing Self-Damping Characteristics of Conductors for Overhead Lines", CIGRÉ Technical Brochure No. 482, December.
11. CIGRÉ Working Group B2-49, 2016, (D. Sunkle convenor; C. Hardy, A. Leblond and P. Van Dyke members), "Safe Design Tensions for Single Conductors Fitted with Elastomer Cushioned Suspension Units", CIGRÉ Technical Brochure No. 653, April.
12. Cloutier, L.J. & C. Hardy, 1988, "Effect of Suspension Clamp Design on Conductor Fatigue Life", R&D Report for the Canadian Electrical Association, Contract # ST-178, October 1988.
13. Hardy, C., 2005 "Assessment of the Technologies for the Design and Verification of Aeolian Damping Systems for Single Conductor Lines", CEATI Report No. T043700-3317A, March.

14. Hardy, C. & M. St-Louis, 2007, "State of the Art: Dampers, Wear Patterns, Replacement Programs", CEATI Report No. T063700-3211, March 2007.
15. IEEE Standard 1368, 2006, (T. Alderton convenor + several co-authors including L.J. Cloutier and C. Hardy), "IEEE Guide for Aeolian Vibration Field Measurements of Overhead Conductors" June 6.
16. Jahier, P., S. Houle and C. Hardy, 1990, "Field Evaluation of Aeolian Vibration of ACSR Bundled Conductors", R&D Report for the Canadian Electrical Association, Contract # 220T553, December.
17. Noiseux, N., C. Hardy, A. Leblond, J. Brunelle & P. Van Dyke, 1996, "Modelling of Single Conductor-Damper System Response", Contract No. 372T823, Canadian Electrical Association, July.

¹ **This repertory includes the publications of Claude Hardy in the field of mechanics and dynamics of overhead lines after his departure from IREQ in 1998 and those of André Leblond up to this day**

² **This directory does not include internal reports nor IREQ industrial reports in the field, which sum up to several dozen.**

APPENDIX B

UNIVERSITÉ LAVAL, GREMCA

DIRECTORY OF PUBLICATIONS

DIRECTORY OF BOOKS

- 1 Cloutier, L., Goudreau, S. and Cardou, A., 2009, "Fatigue of overhead conductors, Chapter 3 of EPRI Transmission Line Reference Book: Wind-Induced Conductor Motion: Second Edition. Palo Alto.

DIRECTORY OF SCIENTIFIC AND TECHNICAL PAPERS

1. Blouin, F. and Cardou, A. A study of helically reinforced cylinders under symmetric loads and application to strand mathematical modelling. Int. J. of Sol. Struc. 1989; 25(2):189-200.
2. Cardou, A. , Discussion. Bending behavior of helically wrapped cables, ASCE J. Engrg Mech. Vol. 131, No 5, pp. 500-511, May 2005. Hong, K-J; Der Kiureghian, A., and Sackman, J. L. ASCE J. Engrg Mech. 2006 Jul; 132(7):790-791.
3. Cardou, A. and Cloutier, L., Discussion: On the bending stiffness of transmission line conductors. IEEE Trans. on Power Delivery. 1997 Oct; 12(4):1586-1587.
4. Cardou, A.; Cloutier, L.; Lanteigne, J., and M'Boup, P. Fatigue strength characterization of ACSR conductors at suspension clamps. Electric Power Systems Research. 1990; 19(1):61-71.
5. Cardou, A. and Jolicoeur, C. Mechanical models of helical strands. App. Mech. Rev. 1997 Jan; 50(1):1-14.
6. Cardou, A.; Leblond, A., and Cloutier, L. Suspension clamp and ACSR electrical conductor contact conditions. ASCE J. of Energy Eng. 1993 Apr; 119(1):19-31.
7. Goudreau, S. and Cardou, A. Flexural testing of an epoxy oversized strand model under traction. Experimental Mechanics. 1993 Dec; 33(4):300-307.
8. Goudreau, S.; Charette, F.; Hardy, C., and Cloutier, L. Bending energy dissipation of simplified single-layer stranded cable. ASCE J. Eng. Mech. 1998 Aug; 124(8):811-817.

9. Goudreau S., Lévesque F., Cardou A. and Cloutier L. Strain measurements on ACSR Conductors During Fatigue Tests II – Stress Fatigue Indicators; IEEE Transactions On Power Delivery, Vol. 25 , No. 4 , October 2010, pp. 2997-3006.
10. Goudreau S., Lévesque F., Cardou A. and Cloutier L. Strain measurements on ACSR Conductors During Fatigue Tests III – Strains related to Support Geometry; IEEE Transactions On Power Delivery, Vol. 25 , No. 4 , October 2010, pp.3007-3016.
11. Hadj-Mimoune, A.; Cardou, A., and El Chebair, A. Free constant curvature bending of axially preloaded strands. Trans. of CSME. 1993; 17(3):325-350.
12. Levesque, F.; Goudreau, S.; Cardou, A., and Cloutier, L. Strain measurements on ACSR conductors during fatigue tests I - Experimental data. IEEE Trans. on Power Delivery. 2010 Oct; 25(4):2825-2834.
13. Levesque, F.; Goudreau, S., and Cloutier, L. Elastic-plastic microcontact model for elliptical contact areas and its application to a trellis point in overhead electrical conductors. J. of Tribology. 2011; 133(1):11401-11409.
14. Levesque, F.; Goudreau, S.; Cloutier, L., and Cardou, A. Finite element model of the contact between a vibrating conductor and a suspension clamp. Tribology International. 2011 Aug; 44(9):1014-1023.
15. Ouaki, B.; Goudreau, S.; Cardou, A., and Fiset, M. Fretting fatigue analysis of aluminium conductor wires near the suspension clamp: metallurgical and fracture mechanics analysis. J. Strain Analysis. 2003; 38(2):133-147.
16. Zhou, Z. R.; Cardou, A.; Fiset, M., and Goudreau, S. Fretting fatigue in electrical transmission lines. Wear. 1994; 173:179-188.
17. Zhou, Z. R.; Cardou, A.; Goudreau, S., and Fiset, M. Fretting patterns in a conductor-clamp contact zone. Fatigue Fract. Engng. Mater. Struct. 1994; 17(6):661-669.
18. ---. Fundamental investigations of electrical conductor fretting fatigue. Tribology Intl. 1996; 29(3):221-232.
19. Zhou, Z. R.; Fiset, M.; Cardou, A.; Cloutier, L., and Goudreau, S. Effect of lubricant in electrical conductor fretting fatigue. Wear. 1995; 189:pp. 51-57.
20. Zhou, Z. R.; Goudreau, S.; Fiset, M., and Cardou, A. Single wire fretting fatigue tests for electrical conductor bending fatigue evaluation. Wear. 1995; 181-183:537-543.

DIRECTORY OF CONFERENCE PAPERS

1. Atali, M. S. and Cardou, A. Energy dissipation and reduction in bending stiffness in axially loaded cable under a constant radius of curvature. Proc. of. Intl. Symp. on Cable Dynamics; Liège, Belgium. Liège; 1995: 117-124.
2. Cardou, A. et Cloutier, L. Conditions de contact entre conducteurs électriques aériens et pinces de suspension [comptes rendus]. Congrès canadien de mécanique appliquée, CANCAM 85; London, Ont. 1985: pp. A53-54.
3. Cardou, A.; Cloutier, L.; Dalpé, C., et Zhou, Z. R. Fatigue en flexion d'un conducteur aérien lubrifié dans la région d'une pince d'entretoise. Comptes rendus du. 15ème congrès canadien de méca. appl., CANCAM 95; Victoria, C.B. 1995 Jun: 196-197.
4. Cardou, A.; Cloutier, L., et Montminy, P. L'essai en fatigue des conducteurs électriques aériens. Comptes rendus du. 10ème congrès canadien de méca. appl. CANCAM 85; London, Ont. 1985: 245-246.
5. Cardou, A.; Cloutier, L.; St-Louis, M., and Leblond, A. ACSR electrical conductors fretting fatigue at spacer clamps. in: Attia, M. H. and Waterhouse, R. B., Eds. Standardization of Fretting Fatigue Test Methods and Equipment; San Antonio, TX. Amer. Soc. for Test. Mat.; 1992: 231-242.
6. Cardou, A.; Dalpé, C., and Hardy, C. Fretting fatigue of the Drake ACSR electrical conductor under cyclic bending at suspension clamp. ISF'97; Chengdu, China. 1997: pp. 200-214.
7. Cardou, A.; Leblond, A.; Goudreau, S., and Cloutier, L. Electrical conductor bending fatigue at suspension clamp: a fretting fatigue problem. in: R.W. Waterhouse and T.C. Lindley, Eds. Fretting Fatigue; Sheffield, U.K. Mechanical Engineering Publications; 1994: 257-266.
8. Cloutier, L.; Dalpé, C.; Cardou, A.; Hardy, C., and Goudreau, S. Studies of conductor vibration fatigue tests, flexural stiffness and fretting behavior. Third Intl Symp. On Cable Dynamics; Trondheim, Norvège. 1999: pp. 197-202.
9. Dalpé, C.; Cardou, A., and Cloutier, L. Fatigue strength characterization of the Drake ACSR electrical conductor performed on two test systems. CANCAM 01, Canadian Congress of Applied Mechanics; St John's, NF. 2001: pp. 79-80.
10. Dalpé, C.; Cardou, A., and Vincent, L. Fretting behaviour of two aluminium wires in contact under a cyclic imposed displacement. CANCAM 99, Canadian Congress of Applied Mechanics; Hamilton, Ont. 1999: pp. 391-392.
11. Goudreau, S.; Jolicoeur, C.; Cardou, A.; Cloutier, L., and Leblond, A. Palmgren-Miner law application to overhead conductor fatigue prediction. Fifth Intl Symp. On Cable Dynamics; Santa-Margherita, Italy. 2003: 501-508.

12. Hadj-Mimoune, A. and Cardou, A. A model for the estimation of damping in helical strand under bending vibration. D. Dowson Ed.. XXth Leeds-Lyon Symposium on Tribology: Dissipative processes in tribology; Lyon. Elsevier Sci. Pub.; 1994 Jun.
13. Hardy, C., Leblond, A., Goudreau, S. and Cloutier, L. Application of contact mechanics to cable self-damping. Third Intl Symp. On Cable Dynamics; Trondheim, Norvège. 1999. pp. 195-202.
14. Hardy, C., Leblond, A., Goudreau, S., and Cloutier, L. Review of models on self-damping of stranded cables in transverse vibrations. Proc. of. Intl. Symp. on Cable Dynamics; Liège, Belgium. 1995: pp. 61-68.
15. Jolicoeur, C. and Cardou, A. Modélisation semi-continue des conducteurs électriques aériens. Comptes rendus. 12ème colloque ATM; Montréal. 1994: 205-214.
16. Jolicoeur, C.; Dalpé, C.; Cardou, A.; Cloutier, L., et Goudreau, S. Contrainte alternée et rigidité apparente en flexion de conducteurs en vibration. Forum SCGM/CSME; Toronto. 1998: pp. 38-45.
17. Observations sur la rigidité apparente en flexion de conducteurs en vibration aux abords d'une pince de suspension. CANCAM 97, 16ème Congrès canadien de mécanique appliquée; Québec. 1997: pp. 153-154.
18. Lanteigne, J.; Cardou, A., and Cloutier, L. Fatigue tests on a typical ACSR conductor [Paper 85-TR-246]. Transactions. CEA Conductor Vibration Workshop; Montréal. Canadian Electrical Association, Engineering and Operating Division; 1985: vol. 5. 18 pages.
19. Lévesque, F.; Goudreau, S.; Langlois, S., and Légeron, F. Experimental study of dynamic bending stiffness of ACSR Drake overhead conductor. 9th Intl Symp. on Cable Dynamics; Shanghai, China. Shanghai; 2011. 8 pages.
20. Li, G., Goudreau, S. , Cardou, A. , Cloutier, L. ; Energie Dissipée par Friction dans un Toron 1 x N1 x N2 sous Flexion selon Différents Modèles de Complaisance Tangentielle [comptes-rendus] Forum SCGM/CSME; Toronto. 1998; Vol. 2, pp 46-51.
21. Li G., Goudreau S., Cardou A. and Cloutier L. ; Tangential Behaviour of Two Bodies in Contact using two Friction Coefficients; CANCAM 97, 16e Congrès Canadien de Mécanique Appliquée; Québec. 1997 : pp. 125-126.
22. Finite element model of vibrating overhead conductors with variable bending stiffness. 9th Intl Symp. on Cable Dynamics; Shanghai, China. Shanghai; 2011. 8 pages.
23. Luc, S.; Goudreau, S.; Légeron, F., and Cloutier, L. Fatigue cumulative damage of overhead conductors. 7th Intl Symp on Cable Dynamics; Vienna, Austria. 2007 Dec.

24. Ouaki, B. ; Goudreau, S., and Cardou, A. Experimental and theoretical analysis of fretting fatigue damage of conductor wires near the suspension clamp using fracture mechanics. 6ème Congrès de mécanique de la Société Marocaine des Sciences Mécaniques; Tanger, Maroc. 2003: 3 pages.
25. ---. Experimental study of wire strains in a conductor suspension clamp under cyclic bending loading. CANCAM 97, 16ème Congrès canadien de mécanique appliquée; Québec. 1997: pp. 149-150.
26. ---. Theoretical and experimental investigations of fretting fatigue damage of aeolian conductor wires near the suspension clamp. African J. of Science and Technology. 2008 Jun; 9(1):29-38.
27. Zhou, Z. R.; Fiset, M.; Cardou, A., and Goudreau, S. Fretting behaviour of overhead electrical conductors under cyclic bending at suspension clamps. IST'93, Intl. Symp. on Tribology; Beijing, China. 1993: 475-484.

DIRECTORY OF REPORTS etc.

1. Arseneault, C. Essais de fatigue sur les câbles aériens de haute tension. Ste-Foy, Qué., Canada: Dép. de génie mécanique, Université Laval; 1987 Apr. 26 pages.
2. Arseneault, C.; Cloutier, L., and Cardou, A. Essais de fatigue du conducteur ACSR Bersfort: rapport n°1. Dép. de génie méc., Université Laval; 1986; SM-86-02. 77 pages.
3. --. Essais de fatigue du conducteur ACSR Bersfort: rapport n°2. Dép. de génie méc., Université Laval; 1987; SM-87-01. 42 pages.
4. --. Essais de fatigue du conducteur ACSR Bersfort: rapport n°3. Dép. de génie méc., Université Laval; 1987 May; SM-87-05. 29 pages.
5. Audet, A. Distribution log-normale pour l'étude en fatigue du conducteur ACSR Bersfort. Ste-Foy, Qué., Canada: Dép. de génie mécanique, université Laval; 1987 Dec 20 pages.
6. Audet, A.; Cloutier, L., and Cardou, A. Essais de fatigue du conducteur ACSR Bersfort: rapport n°5. Dép. de génie méc., Université Laval; 1987; SM-87-11. 72 pages.
7. Audet, A. ; Cloutier, L., and Cardou, A. Essais de fatigue du conducteur ACSR Bersfort: rapport n°6 (final). Dép. de génie méc., Université Laval ; 1988 May; SM-88-01. 112 pages.
8. Cardou, A. Taut helical strand bending stiffness [Web Page]. 2006 Jul. Available at: <http://www.umformtechnik.net/rub/UTFscience/124/UTF+2006/145/archiv/1/2006>.

9. Cardou, A. and Cloutier, L. Indicateurs de fatigue pour les conducteurs électriques aériens dans la région d'une pince de suspension. Québec: Département de génie mécanique, Université Laval; 2001; SM-01-11. 27 pages.
10. Cardou, A.; Cloutier, L., and Dalpé, C. Fatigue tests of Zebra ACSR conductor with André and H.Q. clamps. Ste-Foy, Qué., Canada: dép. de génie mécanique, université Laval; 1994 Jun; SM-94-06. 46 pages. Rapport à National Grid, U.K.
11. Cardou, A.; Cloutier, L., and Goudreau, S. Fretting fatigue under spectrum loading. Application to overhead electrical conductors. Dép. de génie méc., Université Laval; 2003; SM-02-11a. 16 pages. Présenté au groupe de travail WG11/TF7 du comité B2 de Cigré, Moscou, mai 2003.
12. Cardou, A.; Cloutier, L.; Goudreau, S., et Jolicoeur, C. Essais en fatigue des conducteurs compacts AAA-TW (27.8 mm) et ACAR TW-800 (37.1 mm). Dép. de génie méc., Université Laval; 1996; SM-96-11. 16 pages et annexes.
13. Cardou, A.; Cloutier, L., et Leblond, A. Essais en fatigue du conducteur ACSR Bersfort avec pince d'entretoise de type casse-noisette: phase I. Ste-Foy, Qué., Canada: Dép. de génie mécanique, Université Laval; 1991 Apr; SM-91-01. 42 pages.--. Essais en fatigue du conducteur ACSR Bersfort avec pince d'entretoise de type casse-noisette: rapport final. Ste-Foy, Qué., Canada: Dép. de génie mécanique, Université Laval; 1991 Nov; SM-91-02. 50 pages.
14. Cardou, A. et Dalpé, C. Essais en fatigue du conducteur ACSR Drake avec pince de suspension commerciale (10°). Ste-Foy, Qué., Canada: Dép. de génie mécanique, Université Laval; 1994 Aug; SM-94-08. 47 pages.
15. Cardou, A. et Dalpé, C. Conditions statiques de contact au DPC entre un conducteur électrique aérien et une pince de suspension standard. Québec: Département de génie mécanique, Université Laval; 2002 Oct; SM-02-10. 19 pages.
16. Cloutier, L. et Cardou, A. Essais de fatigue du conducteur ACSR Bersfort: rapport n°4. Dép. de génie méc., Université Laval; 1987 Jul; SM-87-06. 4 pages.
17. Cloutier, L.; Goudreau, S., and Cardou, A. Fatigue of overhead conductors. In. EPRI Transmission Line Reference Book: Wind Induced Conductor Motion. 2e ed. Palo Alto, CA: Electric Power Research Institute; 2006 Nov; p. 3.01-3.54 .
18. Cloutier, L.; Goudreau, S., and Cardou, A. Fatigue of overhead electrical conductors. EPRI. Transmission Line Reference Book: wind Induced Conductor Motion: Second Edition. Palo-Alto, CA: Electric Power Research Institute; 2009; 1018554. pp. 3-1 to 3-56.
19. Cloutier, L. and Hardy, C. Effect of suspension clamp design on conductor fatigue life. Canadian Electrical Association; 1987 Jun; CEA No. ST-178. 44 pages.
20. Dalpé, C. Essais en fatigue du conducteur ACSR Drake avec pince de suspension

commerciale (10°). Dép. de génie méc., Université Laval; 1996; SM-96-01. 47 pages.

21. Dalpé, C. and Ouaki, B. Calibration de capteurs d'amplitude relative. Dép. de génie méc. Université Laval; 1995; SM-95-08. 42 pages.
22. Dalpé, C.; Cloutier, L.; Cardou, A., and Goudreau, S. State of knowledge on the fretting behavior in stranded conductors. Dép. de génie méc., Université Laval; 2003 May; SM-03-05. 7 pages. Présenté à la réunion du groupe de travail WG11/TF7 du comité B2 de Cigré, Moscou, mai 2003.
23. Dalpé, C.; Goudreau, S.; Cloutier, L.; Cardou, A., et Fiset, M. Rapport à la société Alcan. Expertise sur les conducteurs électriques aériens Alcan. Dép. de génie méc., Université Laval; 2002; SM-02-08. 98 pages.
24. Goudreau, S.; Cloutier, L., et Cardou, A. Expertise sur un câble de garde Alcan. Dép. de génie méc., Université Laval; 2002; SM-02-12. 24 pages et annexes.
25. ---. Fatigue tests on stranded conductors: return of experience. Cigré WG-11 28th Meeting; Québec. 2001 Jun: Paper 22-01. 27 pages.
26. GREMCA. Essais de fatigue a amplitude variable. 2006; SM-2006-05.
27. --. Essais de fatigue du conducteur ACSS TW-883R à brins trapézoïdaux. 2009; SM-2009-04. 107 pages.
28. --. Essais de fatigue sur le conducteur Drake ACSR. 2006; SM-2006-01.
29. Jolicoeur, C.; Goudreau, S.; Cardou, A., et Cloutier, L. Essais de fatigue d'un conducteur ACSR Crow avec différentes pinces de suspension sous fortes amplitudes de vibration simulant les conditions de galop. Dép. de génie méc., Université Laval; 2005; SM-2005-04. 82 pages et annexes.
30. --. Essais en fatigue du conducteur ACSR Crow avec amplitude variant suivant une distribution de Rayleigh. Dép. de génie méc., Université Laval; 2002 Aug; SM-02-07. 36 pages et annexes.
31. Jolicoeur, C.; Goudreau, S.; Cardou, A., et Cloutier, L. Essais en fatigue sur les conducteurs Bersfort et Drake. Dép. de génie méc., Université Laval; 2001; SM-01-03. 12 pages et annexes.
32. Jolicoeur, C.; Goudreau, S.; Cloutier, L., et Cardou, A. Essais en fatigue d'un conducteur d'aluminium comportant une âme en matériau composite. Dép. de génie méc., Université Laval; 1998; SM-98-01. 13 pages et annexes.
33. --. Essais en fatigue de deux pinces d'entretoise. Dép. de génie méc., Université Laval; 2000; SM-00-01. 24 pages et annexes.

34. --. Essais en fatigue des conducteurs AAAC, Aster 570, AeroZ 683, et TW 683. Dép. de génie méc., Université Laval; 1997; SM-97-09. 17 pages et annexes.
35. --. Essais en fatigue du conducteur Bersfort à des fins d'étude de vie résiduelle. Dép. de génie méc., Université Laval; 2000; SM-2000-09. 9 pages et annexes.
36. --. Étude des caractéristiques mécaniques de câbles de garde à fibres optiques aux abords des points de suspension. Dép. de génie méc., Université Laval; 1999; SM-99-01. 105 pages.
37. Lanteigne, J.; Cloutier, L., and Cardou, A. Fatigue life of aluminum wires in all-aluminum and ACSR conductors. Canadian Electrical Association; 1986 Jul; CEA No. 131-T-241. 200 pages.
38. Leblond, A. Essais de fatigue du conducteur ACSR Bersimis. Dép. de génie méc., Université Laval; 1990 Jun; SM-90-02. 131 pages.
39. Provençal, D. Système moniteur de bancs d'essais de ruptures de câbles. Ste-Foy, Qué., Canada: Dép. de génie mécanique, Université Laval; 1983 May. 26 pages.
- 40.

DIRECTORY OF THESES AND DISSERTATIONS

1. Charette, F. Analyse des caractéristiques d'amortissement d'un cable toronné en régime vibratoire [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1992. 160 pages.
2. Chouinard, G. Analyse des caractéristiques de dissipation d'énergie aux points de contact entre les couches 1 et 2 d'un toron $1 \times n_1 \times n_2$ [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1994. 120 pages.
3. Dalpé, C. Interaction mécanique entre conducteur électrique aérien et pince de suspension : étude sur la fatigue, la rigidité et la FIP [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1999. 269 pages.
4. Goudreau, S. Étude du comportement en flexion des solides toronnés [Thèse de 3ème cycle]. Québec, Canada: Université Laval; 1990. 291 pages.
5. Hadj-Mimoune, A. Modélisation du comportement des solides toronnés en flexion par des couches orthotropes minces [Thèse de 3ème cycle]; Québec, Canada : Université Laval; 1993. 251 pages.
6. Jolicoeur, C. Étude des solides toronnés a l'aide d'un modèle analytique semi-continu [Thèse de 3ème cycle]. Québec, Canada: Université Laval; 1993 May. 206 pages.
7. Labrecque, G. Étude vibratoire des conducteurs aériens de courte portée [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1988. 145 pages.

8. Leblond, A. Interaction mécanique entre conducteur électrique et pince de suspension : conditions de contact et fatigue [Mémoire de 2ème cycle]: Québec, Canada : Université Laval; 1991. 211 pages.
9. Leblond, A. Modèle probabiliste des vibrations éoliennes de portée de conducteur simple, [Thèse de 3ème cycle]: Québec, Canada : Université Laval; 1996. 394 pages.
10. Leghzaoui, O. Fatigue à petits débattements des fils d'aluminium de conducteurs électriques aériens [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1995. 143 pages.
11. Lévesque, F. Analyse de la fatigue par petits débattements (Fretting Fatigue) de fils d'un conducteur électrique [Thèse de 3ème cycle]. Québec, Canada: Université Laval; 2009. 135 pages.
12. ---. Étude de l'applicabilité de la règle de Palmgren-Miner aux conducteurs électriques sous chargements de flexion cyclique par blocs [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 2004. 149 pages.
13. M'Boup, P. Étude de la résistance à la fatigue des conducteurs électriques aériens [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1986. 206 pages.
14. Montminy, P. Étude de la fatigue dans les conducteurs électriques aériens [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 1992. 192 pages.
15. Ouaki, B. Analyse expérimentale et théorique de l'endommagement par fatigue à petits débattements des fils de conducteurs électriques au voisinage d'une pince de suspension [Thèse de 3ème cycle]. Québec, Canada: Université Laval; 1998. 263 pages.
16. Sadki, Yassir. Caractérisation des empreintes de contact de deux fils d'aluminium sous une force normale [Mémoire de 2ème cycle]. Québec, Canada: Université Laval; 2007. 138 pages.
17. Sekouri, El Mostafa. Étude de la contraction radiale d'un toron 1xn sous chargement de traction et de torsion [Mémoire de 2ème cycle]. Université Laval; 1996. 150 pages.

APPENDIX C

UNIVERSITÉ DE SHERBROOKE, GÉNIE MÉCANIQUE

DIRECTORY OF PUBLICATIONS

DIRECTORY OF BOOKS

5. CIGRÉ Task Force B2.11.06, 2007, (J.L. Lilien convenor + several co-authors including P.V. Dyke, A. Laneville and M. St-Louis), "State of the Art on Conductor Galloping", CIGRÉ Technical Brochure No. 322, June. 140 p.
6. Diana, G., U. Cosmai, A. Laneville, A. Manenti, D. Hearnshaw, K. Papailiou, 2009 "Aeolian Vibration", Chapter 2 of EPRI Transmission Line Reference Book: Wind-Induced Conductor Motion: Second Edition. EPRI. Palo Alto, CA. 158 p.
7. Van Dyke, P., Havard D. and Laneville, A., 2008, "Atmospheric Icing of Power Networks", Chapter 5 of "Effect of ice and snow on the dynamics of transmission line conductors", ISBN 978-1-4020-8530-7, M. Farzaneth, ed., 41 p.

DIRECTORY OF SCIENTIFIC AND TECHNICAL PAPERS

1. Brika, D., Laneville, A., Vittecoq, P., 1990, "Étude expérimentale des vibrations éoliennes d'un cylindre flexible- 1", Trans. S.C.G.M, vol 14, no 4, pp 101-108.
2. Brika, D., Laneville, A., Vittecoq, P., 1992, "Les oscillations induites par l'émission tourbillonnaire dans le cas d'un long cylindre circulaire", J. of Wind Engrg and Ind. Aero., vol 41, pp. 627-637.
3. Brika, D., Laneville, A., "Vortex induced vibrations of a long flexible circular cylinder", J. of Fluid Mechanics, vol 250, p 481-508.
4. Brika, D., Laneville, A., 1995, "A laboratory investigation of the Aeolian power imparted to a conductor using a flexible circular cylinder", IEEE Trans. on Power Delivery, vol 11, no 2 pp. 1145-1153.
5. Brika, D., Laneville, A., 1995, "A laboratory investigation of the aeolian power imparted to a conductor using a flexible circular cylinder", J. of Fluids and Structures, vol. 9, pp. 371-391.
6. Brika, D., Laneville, A., 1997, "Wake interference between two circular cylinders", J. of Wind Engrg and Ind. Aero., Vol. 72, pp. 61-70.

7. Brika, D., Laneville, A., 1997, "Vortex-Induced oscillations of two flexible circular cylinders coupled mechanically", J. of Wind Engrg and Ind. Aero., vol 69-71, pp. 293-302.
8. Brika, D., Laneville, A., 1999, "The flow interaction between a stationary cylinder and a downstream flexible cylinder vibrating in different plane", Journal of Fluids and Structures, vol. 13, No 5, pp. 579-606.
9. CIGRÉ Task Force B2.11.01, 2005, (G. Diana convenor + several co-authors including C. Hardy, A. Leblond, A. Laneville and L. Cloutier), "Modelling of Aeolian Vibrations of a Single Conductor plus Damper: Assessment of the Technology", Electra No. 223, December, pp. 28-36.
10. CIGRÉ Task Force B2.11.06, 2007, (J.L Lilien convenor + several co-authors including P.V. Dyke, A. Laneville and M. St-Louis), "State of the Art on Conductor Galloping", Electra No. 232, June, pp. 20-25.
11. Laneville, A., Brika, D., 1999, "The fluid and mechanical coupling between two circular cylinders in tandem arrangement", (invited lecture), Journal of Fluids and Structures, vol. 13, No 7/8, pp. 967-986.
12. Laneville, A., 2006, "On vortex-induced vibrations of cylinders describing X-Y trajectories", Journal of Fluids and Structures, vol. 22, No 6/7, pp. 773-782.
13. Van Dyke, P., Laneville, A., 2008, "Galloping of a single conductor covered with a D-section on a high voltage overhead test line", Int. J. of Wind Engineering and Industrial Aerodynamics, Vol. 96, no 6-7, pp. 1141-1151.

DIRECTORY OF CONFERENCE PAPERS

1. Dallaire, P.O., Cuesta-Lavoie, D., Fillion, S., Laneville, A., 2004, "Flow Visualization of jumps between modes of vortex shedding in the case of a Long Flexible Cylindrical Tube", 5th Int. Conf. on BBAA, Ottawa, Canada.
2. Brika, D., A. Laneville, P. Vittecoq, 1990, "Sur les vibrations éoliennes d'un cylindre flexible", CSME Mechanical Engrg Forum, Univ. of Toronto, Ont., juin.
3. Brika, D., A. Laneville, P. Vittecoq, 1991, "Étude expérimentale des vibrations éoliennes d'un cylindre flexible- 2", Proc. 8th Int. Conf. on Wind Engrg, London, Ont., 8-12 July.
4. Brika, D., A. Laneville, 1993, "Vortex-induced oscillations of a circular cylinder vibrating in different incident planes", Comptes-rendus CANCAM, Kingston, Ont., Canada, vol. 1, p. 251.
5. Brika, D., A. Laneville, 1994, "Études en soufflerie de deux cylindres flexibles",

Proc. Conf. Électricité 94, sections techniques, A.C.E., Toronto, Ont.

6. Brika, D., A. Laneville, 1994, "The Aeolian vibrations of a flexible cylinder in the wake of a fixed cylinder", Proc. 12th Symp. On Engineering Applications of Mechanics, McGill Univ., Montreal, June.
7. Brika, D., A. Laneville, 1995, "Wake interference between two circular cylinders", Proc. 9th Int. Conf. on Wind Engrg, New Delhi, India, 9-13 Jan.
8. Brika, D., A. Laneville, 1995, "The hysteresis and bifurcation phenomena in the Aeolian vibrations of a circular cylinder", Proc. 6th Int. Conf. on Flow Induced Vibrations, Imperial College, London, U.K., 10-12 April.
9. Brika, D., A. Laneville, 1996, "Vortex-Induced vibrations of a twin cylinder bundles", ASME Symp. on Flow-Induced Vibrations, Radisson Hotel, Montréal, 21-26 July.
10. Laneville, A., Brika, D., 1997, "Vortex-Induced oscillations of two flexible circular cylinders coupled mechanically", Proc. BBAA III, Virginia Tech., Blacksburg, Virginia, USA, July 28-Aug. 1.
11. Brika, D., A. Laneville, 1999, "An experimental study of the power imparted by wind to a twin cylinder bundle", Proc. 10th Int. Conf. on Wind Engrg, Copenhagen, Denmark, June 21-24, , p. 1619 à 1625.
12. Brika, D., A. Laneville, 1999, "Effect of turbulence and mechanical coupling on the Aeolian vibration of two circular cylinders in tandem arrangement", Proc. ASME Symposium on Flow Induced Vibration, Boston, August 1-5.
13. Laguë, F., Laneville, A., 2002, "Vortex-induced vibrations of a flexible cylinder in a slowly varying flow: experimental results-1", 5th International Symposium on FSI, AE & FIV + N, New Orleans, Louisiana, 17-22 Nov.
14. Laguë, F., Laneville, A., 2004, "Vortex-induced vibrations of a flexible cylinder in a slowly varying flow: experimental result-2", 5th Int. Conf. on BBAA, Ottawa, Canada.
15. Laneville, A., Brika, D., 1997, "Vortex-Induced vibrations of single and twin flexible circular cylinders: an overview of some experimental results", Proc. 6th CASI Aerodynamics Symp. and 44th Annual Conf. Of the NRC-IAR, p 429.
16. Laneville, A., Brika, D., 1997, "Les vibrations éoliennes de différentes configurations de câbles", Comptes rendus 16^{ième} cong. CANCAM, Québec, Qc, Canada, vol. 1, p. 267
17. Laneville, A., Stoyanoff, S., Forget, P., 1997, "Sur les vibrations éoliennes en turbulence atmosphérique", Comptes rendus 16^{ième} cong. CANCAM, Québec, Qc, Canada, vol. 1, p. 271.

18. Laneville, A., 1997, 'Different flow regimes in vortex-induced vibrations', (invited lecture), Proc. FLUCOME 1997, 5th triennial Symp., Hayama, Japan, Vol 1, p.21.
19. Laneville, A., 2001, 'Experimental simulation of the fluid and mechanical coupling between transmission line conductors', 4th International Symposium on Cable Dynamics, Montréal, Québec, 28-30 May.
20. Laneville, A., 2005, 'Experiments on VIV of a long flexible cylinder vibrating freely in air: critical curve and existence of the 2P and 2S modes', (invited lecture), 4th Symp. on Bluff Body Wakes and Vortex-Induced Vibrations, Santorini, Greece, June 21-24.
21. Laneville, A., Dallaire, P.-O., 2006, 'Phase angle in transient regimes of vortex-induced vibration: an experimental determination', Proc. ASME 6th FSI, AE & FIV+N Symp., Paper no 93858, Vancouver July 23-27, Canada.
22. Laneville, A., Matsumoto, M., 2011, "Galloping of a cylinder fitted with thin protrusion", Proc. 13th Int. Conf. on Wind Engrg, Amsterdam, The Netherlands, July 10-15.
23. Matsumoto, M., Laneville, A., 2011, "Generation of galloping of bluff bodies in relation with "Karman" vortex shedding", Proc. 13th Int. Conf. on Wind Engrg, Amsterdam, The Netherlands, July 10-15.
24. Van Dyke, P., Desrochers, G., Guilbault, P., Hamel, M., Laneville, A., 2001. "Design and validation of an interphase space for twin bundles", 4th International Symposium on Cable Dynamics, Montréal, Québec, 28-30 mai.
25. Van Dyke, P., Laneville, A., 2004, "Galloping of a single conductor covered with a D-section on a high voltage overhead test line", 5th Int. Conf. on BBAA, Ottawa, Canada.
26. Van Dyke, P., Laneville, A., 2005, "HWAS Clamp Performance on a High Voltage Overhead Test Line, 6th Int. Symposium on Cable Dynamics, Charleston, SC (USA), Sept 19-22.
27. Van Dyke, P., Laneville, A., Bouchard, D., 2006, "Galloping experimental analysis of conductors covered with a D-section on a high voltage overhead test line", Proc. ASME 6th FSI, AE & FIV+N Symp., paper no 93962, Vancouver July 23-27, Canada.
28. Van Dyke, P., Laneville, A., 2008, "Displacement prob. dist. in the case of galloping of conductors with a D section on a High Voltage Overhead Test Line", BBAA VI Int. Col. on Bluff Bodies Aerodynamics & Applications, Milano, Italy, July, 20-24.
29. Van Dyke, P., Laneville, A., 2008, "Galloping of a single conductor covered with a D-section on a high voltage overhead test line",

30. Van Dyke, P., Laneville, A., 2009, " Simulated Ice Shedding on a Full Scale Test Line", ISCD 2009, 8th Int. Symposium on Cable Dynamics, Paris, France, Sept 20-23.

DIRECTORY OF THESES AND DISSERTATIONS

1. Brika, D., 1990, "Étude expérimentale des vibrations éoliennes d'un cylindre flexible à différentes incidences", Thèse de doctorat.
2. Cuong, H.M., 2015, "Évaluation des charges de fatigue des haubans des ponts haubanés sous l'action du vent et des véhicules", Thèse de doctorat.
3. Dallaire, P.O., "Étude des vibrations éoliennes instationnaires", Mémoire de maîtrise.
4. Forget, P. "Étude de l'effet de la turbulence atmosphérique sur les vibrations éoliennes de câbles", Mémoire de maîtrise.
5. Jaguë, F., "Étude expérimentale de l'effet de la turbulence de grande échelle sur les vibrations éoliennes d'un long cylindre flexible", Mémoire de maîtrise.
6. Prud'homme, S., "Développement d'un banc d'essai actif et passif à 3 DDL pour essais sectionnels en soufflerie", Mémoire de maîtrise.
7. Prud'homme, S., "Simulation dynamique transitoire non linéaire du flottement d'un modèle sectionnel non profilé à 3 DDL", Thèse de doctorat.
8. Van Dyke, P., " Galop induit sur une ligne expérimentale à l'aide de profilés en D sur conducteur simple avec ou sans entretoises interphases", Thèse de doctorat.

APPENDIX D

CHAIR / RESEARCH GROUP HQ-RTE

ON OVERHEAD LINES

DIRECTORY OF PUBLICATIONS

DIRECTORY OF REPORTS, THESES AND DISSERTATIONS

- R1. F. Lévesque. 2009. *Analyse de la fatigue par petits débattements ("fretting fatigue") de fils d'un conducteur électrique*. 160 pages. Thèse de doctorat.
- R2. R. Erfani. 2009. *De-aggregated-risk analysis of freezing rain using reliability methods*. 141p.
- R3. E. Morissette. 2009. *Évaluation des normes de calcul et du comportement des cornières simples en compression utilisées comme contreventements dans les pylônes à treillis en acier*. 234p. Mémoire de maîtrise.
- R4. L.-V. Beaulieu. 2009. *Corrosion des cornières de fondation, existence et conséquence*. 230p. Mémoire de maîtrise.
- R5. P.-O. Dallaire. 2009. *Étude des vibrations éoliennes instationnaires*. 113p. Mémoire de maîtrise.
- R6. M. Ashby. 2009. *Analyse dynamique des lignes de grande portée sous charge de vent*. 73p. Mémoire de maîtrise.
- R7. D. Bazonga. 2009. *Étude expérimentale du comportement en flambement local des pylônes tubulaires*. 177p. Mémoire de maîtrise.
- R8. L.-P. Bérubé et F. Légeron. 2009. *Influence de la flexibilité et de la ductilité des pylônes sur le comportement des lignes de transport d'énergie électrique*. Rapport Chaire SML. 106p.
- R9. E. Baril, M. Demers et F. Légeron. 2009. *Utilisation des pylônes en béton à haute performance dans les lignes de transport*. Rapport Chaire SML. 33 p.
- R10. F. Légeron, B. Marmion et V. Gagné. 2009. *Utilisation des matériaux composites dans les lignes aériennes de transport d'énergie électrique*. 139p.
- R11. F. Gani. 2011. *Réponse dynamique des structures sous charges de vent*. Thèse de doctorat.
- R12. V. Gagné. 2011. *Utilisation de matériaux composites dans les structures de lignes de transport d'énergie électrique*. Mémoire de maîtrise.
- R13. J-P. Paradis 2011. *Modélisation de la flexion libre d'un câble multicouche tenant compte de l'élasticité des contacts*. Mémoire de maîtrise.
- R14. M.K. Trân 2010. *Effort du vent sur le pylône à treillis*. Mémoire de maîtrise
- R15. S. Prud'homme. 2010. *Développement d'un banc d'essai actif et passif à 3 DDL pour essais sectionnels en soufflerie*. Mémoire de maîtrise.
- R16. E. Desjardins. 2011. *Implémentation de fusibles pour réduire les efforts sismiques aux connexions boulonnées de contreventement*. Mémoire de maîtrise.
- R17. J-Y. Taillon. 2011. *Variation de la rigidité et de l'amortissement d'une section de pylône à treillis en fonction du niveau de sollicitation*. Mémoire de maîtrise.
- R18. L-P. Bérubé. 2012. *Analyse dynamique non-linéaire des structures de lignes électriques lors de bris de conducteurs*. Mémoire de maîtrise.
- R19. S.Langlois. 2013. *Prédiction des vibrations éoliennes d'un système conducteur-amortisseur avec une méthode temporelle non linéaire*. Thèse de doctorat.

- R20 P.-L. Bouchard. 2013. *Calcul de la capacité de pylônes à treillis avec une approche stabilité*. Mémoire de maîtrise.
- R21 J. Dubuc. 2014. *Influence de l'endommagement cumulatif en fatigue sur la résistance en compression et en traction de cornière d'acier*. Mémoire de maîtrise.
- R22 D. Penagos. 2014. *Renforcement au moyen de PRFC d'assemblages d'acier boulonnés en traction*. Mémoire de maîtrise.
- R23 T. Egron. 2014. *Modification d'un pylône de ligne aérienne de transport d'énergie pour le rehaussement des conducteurs*. Mémoire de maîtrise.
- R24 O. L. Naouali. 2014. *Étendue des ruines en cascade des structures des lignes de transport d'énergie en fonction des charges de conception*. Mémoire de maîtrise.

DIRECTORY OF SCIENTIFIC AND TECHNICAL PAPERS

- A1. F. Gani et F. Légeron. 2010. Dynamic Response of Transmission Lines Guyed Towers under Wind Loading. *Canadian Journal of Civil Engineering*. Vol. 37, no 3, pp. 450-464.
- A2. F. Lévesque, S. Goudreau, A. Cardou, L. Cloutier. 2010. Strain measurements on ACSR conductors during fatigue tests I – Experimental method and data. *IEEE Transactions on Power Delivery*, vol. 25, no. 4, pp. 2825-2834.
- A3. S. Goudreau, F. Lévesque, A. Cardou, L. Cloutier. Strain measurements on ACSR conductors during fatigue tests II - Stress fatigue indicator, *IEEE Transactions on Power Delivery*, vol. 25, no. 4, pp. 2997-3006.
- A4. S. Goudreau, F. Lévesque, A. Cardou, L. Cloutier. Strain measurements on ACSR conductors during fatigue tests III - Strains related to support geometry, *IEEE Transactions on Power Delivery*, vol. 25, no. 4, pp. 3007-3016.
- A5. F. Légeron, J. da Silva et GT B2.08 2009. Conception et études de détail des pylônes en treillis – Comparaison entre les différentes pratiques industrielles générales / Comparison of general industry practices for lattice tower design and detailing, *Electra(CIGRÉ)* Vol. 244, Brochure 384.
- A6. F. Légeron, et J. DaSilva et groupe de travail CIGRÉ B2-WG8. Effects of fabrication and erection imperfection on transmission tower member forces. Accepté dans le journal *Electra (CIGRÉ)*. L'article a été rédigé avec l'étudiant E. Desjardins.
- A7. L-V. Beaulieu, F. Legeron, S. Langlois. 2010. Compression strength of corroded steel angles members. *Journal of Constructional Steel Research* Vol. 66(11), p. 1366-1373.
- A8. F. Lévesque, S. Goudreau, L. Cloutier. 2011. Elastic-plastic microcontact model for elliptical contact areas and its application to a treillis point in overhead electrical conductors. *Journal of Tribology*, Vol 133, no 1, (9 pages).
- A9. A. Jendoubi, M. Karray and F. Légeron. 2011. Displacement functions for layered and inhomogenous soils. *International Journal of Geotechnical Engineering*, Issue 2, April 2011.
- A10. F. Lévesque, S. Goudreau., L. Cloutier, A. Cardou. 2011. Finite element model of the contact between a vibrating conductor and a suspension clamp, *Tribology International*, 44(9), pp. 1014-1023.

- A11. J-Y. Taillon, S. Prud'homme et F. Légeron. 2012. Variation of Damping and Stiffness of Lattice Towers with Load Level. *Journal of Constructional Steel Research*. Vol. 71 pp. 111-118.
- A12. A. Godat, F. Légeron et D. Bazonga. 2012. Stability Investigation of Local Buckling Behavior of Tubular Polygon Columns under Concentric Compression. *Journal of Thin Wall Structures*. Vol. 53 pp. 131-140.
- A13. F. Gani and F. Légeron. 2012. Relationship between specified ductility and strength demand reduction for single degree-of-freedom systems under extreme wind events. *Journal of Wind Engineering and Industrial Aerodynamics*. Vol. 109 pp.31-45.
- A14. A. Godat, F. Legeron, V. Gagné, et B. Marmion. 2013. Use of FRP pultruded members for electricity transmission towers. *Journal of composite structures*. Vol. 105 pp. 408-421.
- A15. S. Langlois, F. Légeron, F. Lévesque. 2013. Time history modelling of vibrations on overhead conductors with variable bending stiffness. *IEEE Transactions on Power Delivery*. Vol. 29, No 2, pp.607-614.
- A16. S. Langlois, F. Légeron. 2013. Prediction of aeolian vibration on transmission line conductors using a non-linear time history model-Part I: Damper model. *IEEE Transactions on Power Delivery*. (Sous presse)
- A17. S. Langlois, F. Légeron. 2013. Prediction of aeolian vibration on transmission line conductors using a non-linear time history model-Part II: Conductor and damper model. *IEEE Transactions on Power Delivery*. (Sous presse)
- A18. S. Prud'homme, F.Légeron, A. Laneville, M. K. Tran. 2014. Wind forces on angle members alone and in the wake of another member. *Journal of Wind Engineering and Industrial Aerodynamics*. Vol. 124, p. 20-28.

DIRECTORY OF CONFERENCE PAPERS

- C1. F. Gani, F. Légeron et M. Ashby. 2009. Turbulent Wind Loading Studies on Transmission Line Structures. *Electrical Transmission and Substation Structure Conference. Fort Worth, Texas, USA*.
- C2. F. Légeron et F. Gani. 2009. Dynamic Wind Effect on Transmission Line Structures. *International Seminar on Modeling and Identification of Structures Subjected to Dynamic excitation. Emphasis to Transmission Lines. Bento Gonçalves. Brésil*.
- C3. F. Gani, L.-P. Parent, F. Légeron, S. Stoyanoff and P. Van Dyke. 2009. Three Dimensional Wind Correlation: Estimations from in-situ measurements. *ASCE Structures Congress '09. Austin, Texas. USA.000*
- C4. Q.-H. Nguyen, F. Légeron et T.-P. Le. 2009. Effect of dynamic wind force on structures using spectral approaches with complex modal analysis. *11th Americas Conference on Wind Engineering – San Juan, Puerto Rico*.
- C5. Q.-H. Nguyen et F. Légeron. 2009. Turbulent Wind Load on Icing Conductors using Spectral Approaches with Complex Modal Analysis. *International Symposium on Cable Dynamics. Paris*.
- C6. L.-V. Beaulieu, F. Légeron, S. Langlois, et S. Prud'homme. 2009. Residual Capacity in Compression of Corroded Steel Angle Members. *Electrical Transmission and Substation Structure Conference. Fort Worth. Texas, USA*.

- C7. F. Légeron, B. Marmion. Composite materials for structures of transmission lines with raised voltage. *RTE symposium*, Paris, Mars 2009.
- C8. F. Légeron, L.-V. Beaulieu, S. Langlois, S. Prud'homme. Residual capacity in compression of corroded steel angle members. *RTE symposium*, Paris, Mars 2009.
- C9. S. Langlois, F. Gani, et F. Légeron. 2010. Wind loading on transmission line conductors: comparison between industry documents, field measurements and advanced methods. *EDM International Conference on Overhead Lines Design, Construction, Inspection, and Maintenance*, le 29 mars -le 1 avril 2010, Fort Collins, Colorado, USA.
- C10. S. Langlois, F. Lévesque, F. Legeron. 2010. Time history finite element modeling of a vibrating transmission line conductor. *3rd Symposium on the Mechanics of Slender Structures*, les 21-23 juillet 2010, San Sebastian, Espagne.
- C11. F. Lévesque, F. Légeron. 2010. Contact mechanics based fatigue indicator for overhead conductors. *3rd Symposium on the Mechanics of Slender Structures*, les 21-23 juillet 2010, San Sebastian, Espagne.
- C12. B. Marmion, A. Godat, V. Gagné et F. Légeron. 2010. Behaviour and Design of FRP Composite Members Subjected to Axial Compression or Bending. *Congrès Annuel de la Société canadienne de génie civil*, Winnipeg, 9-12 juin 2010.
- C13. S. N. Rezaei, L. Chouinard et F. Légeron. 2011. A Comparison of Wind and Ice Loads for the Design of Transmission Lines, *IWAIS 2011*, Chongqing, China, May 8-13, 2011.
- C14. F. Gani et F. Légeron. 2011. Ductility of single-degree-of-freedom system under extreme wind loading, *Eurodyn 2011: 8th International Conference on Structural Dynamics*, Leuven, Belgique, 4 -7 juillet 2011, 8p.
- C15. F. Légeron et A. Godat. 2011. A New Design Equation for the Local Buckling Capacity of Thin-walled Tubular Polygon Columns. *Eurosteel 2011*, August 31 - September 2, 2011, Budapest, Hungary.
- C16. A. Godat, Frederic Legeron and Dieudonné Bazonga. 2011. Local Buckling Behaviour of Thin-walled Tubular Polygon Columns under Axial Compression. *6th International Conference on Thin Walled Structures*, 05 – 07 September 2011, Timisoara, Romania.
- C17. J. Dubuc, S. Langlois et F. Legeron . 2011. Prediction of the Compressive Capacity of Steel Angles: Evaluation of Eurocode and other international codes with existing experimental data. *Eurosteel 2011*, August 31 - September 2, 2011, Budapest, Hungary
- C18. T. Tajeuna, F. Légeron et P. Labossière. 2011. Static Behaviour of Multi-material Connections. *35th International Symposium on Bridge and Structural Engineering*, London, UK, September 20-23, 2011.
- C19. S. Langlois, F. Lévesque, F. Légeron. 2011. Finite element model of vibrating overhead conductors with variable bending stiffness. *International Symposium on Cable Dynamics 2011*, Shanghai, Chine, 18-20 octobre 2011.
- C20. J-P. H. Paradis, F. Legeron. 2011. Modelling of the free bending behaviour of a multilayer cable taking into account the tangential compliance of contact interfaces. *International Symposium on Cable Dynamics 2011*, Shanghai, Chine, 18-20 octobre 2011.
- C21. F. Lévesque, F. Légeron. 2011. Effect of mean tension on interwire contacts in overhead conductors. *International Symposium on Cable Dynamics 2011*, Shanghai, Chine, 18-20 octobre 2011.
- C22. F. Lévesque, S. Goudreau, S. Langlois et F. Légeron. 2011. Experimental study of dynamic bending stiffness of overhead conductors. *International Symposium on Cable Dynamics 2011*, Shanghai, Chine, 18-20 octobre 2011.

- C23. A. Laneville et M. Matsumoto. 2011. Galloping of a cylinder fitted with a thin protrusion. *Proceedings 13th International Conference of Wind Engineering*, Amsterdam, Pays-Bas, 10-15 juillet 2011.
- C24. M. Matsumoto et A. Laneville. 2011. Generation of galloping of a bluff body in relation with Karman vortex. *Proceedings 13th International Conference of Wind Engineering*, Amsterdam, Pays-Bas, 10-15 juillet 2011.
- C25. A. Jendoubi, F. Légeron. 2012. Effect of the dynamic soil-structure interaction on rigid transmission line towers subjected to wind and impulse loads. *Electrical Transmission and Substation Structures (ETS) Conference ASCE*, Columbus, Ohio, USA, 4-8 novembre 2012.
- C26. S.N. Rezaei, L. Chouinard, F. Legeron, 2013. Consideration of wind direction on the reliability of transmission tower systems. *3rd Specialty Conference on Material Engineering & Applied Mechanics (CSCE 2013)*, Montreal, Canada, June 2013.
- C27. A. Godat, F. Legeron, V. Gagné. 2013. Design Example of Use of FRP Pultruded Members for Electricity Transmission Towers. *FRPRCS11 – 11th International Symposium on Fiber Reinforced Polymer for Reinforced Concrete Structures*, Guimarães, June 26-28, 2013.
- C28. S.N. Rezaei, L. Chouinard, F. Legeron. 2013. Reliability analysis for transmission line systems for atmospheric hazard. *11th International Conference on Structural Safety & Reliability (ICOSSAR)*, New York, United states, June 2013.
- C29. F. Légeron. 2011. Fiabilité mécanique et augmentation de la capacité de transit. Forum R&D – CNER DL, Paris, France, 17 Novembre 2011.

APPENDIX E



Fig. E-1. Magdalen Islands Test Line



Fig. E-2. Magdalen Islands Test Line control and instrumentation room

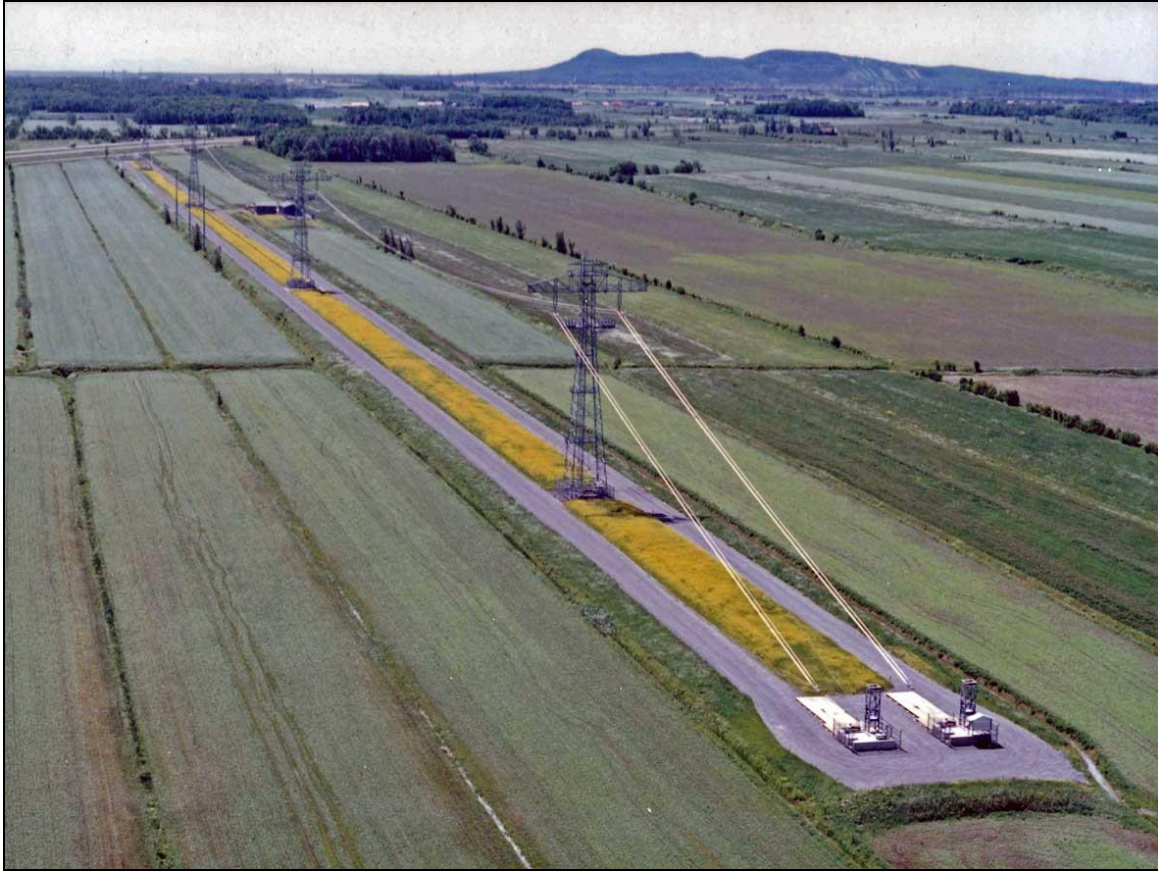


Fig. E-3. Varennes Test Line

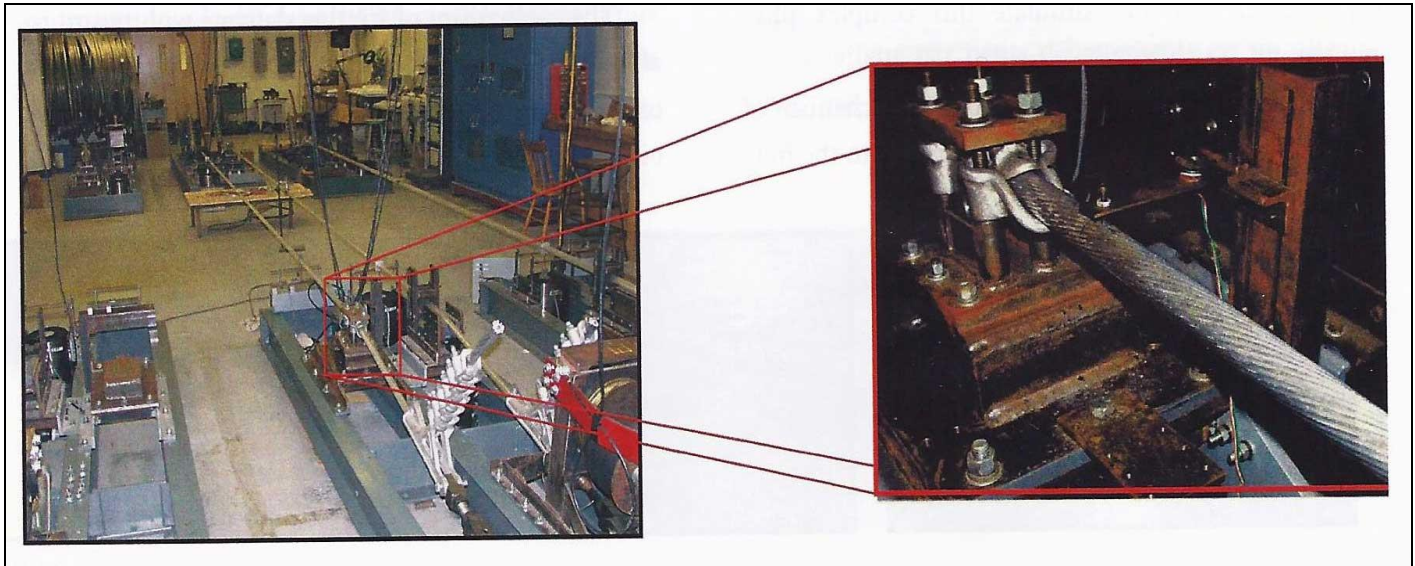


Fig. E-4. Université Laval conductor-clamp fatigue test benches



Fig. E-5. Hydro-Québec quad spacer-damper



Fig. E-6. PAVICA Aeolian Vibrations sensor-analyser-recorder



Fig. E-7. A 12-conductor bundle mounted at the Magadalen Island Test Line using a pivotable suspension for a study carried out on behalf of American Electric Power.



**Fig. E-8. Photo en gros plan du faisceau de 12 conducteurs montré à la Fig. E-7.
[Crédit: Serge Houle, ing., M.Sc.A., MBA, alors ingénieur résident]**

NB: This beautiful photo taken by Serge Houle in 1979 has a long history having been used to illustrate the annual reports of IREQ, Hydro-Québec and the Canadian Electrical Association and CIGRÉ Electra magazine. It was also used for a time as a background for Hydro-Québec's pay checks and as a cover page for a promotional brochure of the Quebec Ministry of Industry and Commerce translated into several languages and widely distributed abroad.

**APPENDIX F: DIRECTORY OF TUTORIALS
IN RELATION TO CIGRÉ WG B2.11(TAG-B2-06)**

TUTORIAL	DATE	VENUE	GIVEN BY	COMMENT
Tf3 Fittings for Optical	August 2004	Paris SCB2	T J Smart	Given to SCB2
Tf4 Safe Design	September 2005	Rio de Janeiro	C Hardy	100+ Participant
Tf4 Safe Design	October 2005	Universite de Sherbrooke Canada	C Hardy	15 Participants
Assessment of Aeolian	September 2005	Rio de Janeiro	U Cosmai	100+ Participant
Tf4 Safe Design	February 2006	Hydro Quebec Montreal	C Hardy	25 Participants
Tf4 Safe Design	March 2006	Hydro Quebec Quebec City	C Hardy	20 Participants
Tf4 Safe Design	March 2006	Athens, Greece	L Cloutier	Public Power Corporation, Greece
Assessment of Aeolian	March 2006	Athens, Greece	U Cosmai	Public Power Corporation
Tf4 Safe Design	May 2006	Universite de Sherbrooke Canada	C Hardy	15 Participants
Tf4 Safe Design	June 2006	IEEE PES TPC Montreal	C Hardy	50+ Participant
TF4 Safe Design Tensions	Sept. 2006	Comision Federal de Electricidad Mexico	C Hardy	30 Participants
Tf4 Safe Design	May 2007	Universite de Sherbrooke Canada	C Hardy	15 Participants
TfG Galloping	Dec 2007	Cable Dynamics Conference	J L Lilien	21 Participants
TfG Galloping	7/8 Jan 2008	Sherbrooke University	J L Lilien	30 Participants
TfG Galloping	Jan 2008	IEEE Las Vegas	D G Havard	100 Participant
TfG Galloping	April 2008	WISMIG, Arlington	J L Lilien	TBA
Tf4 Safe Design	Jan 2009	IEEE Atlanta	D G Havard	80 Participants

TUTORIAL	DATE	VENUE	GIVEN BY	COMMENT
Tf3 Fittings for Optical Fibre	April 2009	Bruges	D C Sunkle	14 Participants
Assessment of	April 2009	Bruges	U Cosmai	14 Participants
Tf4 Safe Design	April 2009	Bruges	A Leblond	14 Participants
WG 32 – Aged	September 2011	EA Technology Chester	W Troppauer	25 Participants
Assessment of Aeolian	February 2011	CIGRE Seminar Bangkok	U Cosmai	49 Participants
Spacer & Spacer Dampers	February 2011	CIGRE Seminar Bangkok	U Cosmai	49 Participants
Types and uses of HT conductors (B2-	February 2011	CIGRE Seminar Bangkok	B Wareing	49 Participants
Tf4 Safe Design	February 2011	Thailand	A Leblond	49 Participants
Conductor Fatigue (B2-30)	February 2011	CIGRE Seminar Bangkok	A Leblond	49 Participants
B2-33 Working safe on aged	February 2011	Thailand	P Dulhunty	49 Participants
B2-31 Modelling of Aeolian vibrations	February 2011	CIGRE Seminar Bangkok	G Diana	49 Participants
TF-3 Fittings for	February 2011	Thailand	D Sunkle	49 Participants
WG 32 - Aged Fittings	February 2011	CIGRE Seminar Bangkok	D Sunkle	49 Participants
TfG Galloping	June 2011	Seminar	D G Havard	
B2.30 Conductor Fatigue	July 2011	Seminar Ausgrid Sydney	P Dulhunty	60 Participants
B2.30 Conductor Fatigue	July 2011	Seminar Ausgrid Sydney	P Dulhunty	45 Participants
Assessment of Conductor	September 2011	Conference Bucharest	U Cosmai	40 Participants
B2.30 Conductor Fatigue	March 2012	Conference Powergrid India	A Leblond	100 Participants

TUTORIAL	DATE	VENUE	GIVEN BY	COMMENT
Tf4 Safe Design	March 2012	Conference Powergrid	A Leblond	100 Participant
Tf4 Safe Design Tensions	March 2013	2013 Colloquium of the HQ/RTE	A Leblond	200 Participants
WG48 HT-Conductor	June 2013	The electric energy society of	P. Dulhunty	40 Participants
Tf4 Safe Design Tensions	October 2013	Sask Power, Canada	D. Havard	16 Participants
WG48 HT-Conductors	February 2014	China State Grid	J. Huang	60 Participants