

# Dr Thierry FOURCAUD

Born 19<sup>th</sup> March 1963 at Libourne, France

French nationality, Single and Male

Research Scientist CIRAD-dept BIOS

**Director UMR AMAP : botAnique et Modélisation  
de l'Architecture des Plantes et des végétations**



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Professional address

UMR AMAP  
TA40/PS2, Boulevard de la Lironde

34398 MONTPELLIER CEDEX 5 (FRANCE)

Tel Sec. +33 (0)4 67 61 75 25

Fax +33 (0) (0)4 67 61 56 68

<http://amap.cirad.fr>

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## HDR (equivalent to DSc) THESIS

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- 2004**      **HDR Thesis in Mechanics and Engineering Sciences (University Bordeaux I, France)**  
*Modelling of the relationships between morphogenesis and biomechanics at the tree level and applications*

## PhD THESIS

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- 1995**      **PhD Thesis in Applied Mathematics (University Bordeaux I, France)**  
*Analysis of the mechanical behaviour of a growing plant using the finite element method*  
(Supervision: Dr Patrick Lac, Prof. Pierre Morlier, Prof. Jean-Luc Joly)

## POSITION

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- Since 2015**      **Director** of **UMR AMAP** (Joint Unit CIRAD-CNRS-INRA-IRD-Univ. Montpellier II, Montpellier, France, <http://amap.cirad.fr> ).
- 2012-2014**      **Deputy Director** of **UMR AMAP** (Joint Unit CIRAD-CNRS-INRA-IRD-Univ. Montpellier II, Montpellier, France, <http://amap.cirad.fr> ).
- 2007-2012**      **Co-head** of the team “Plant Architecture Functioning and Evolution” at **UMR AMAP**.
- 2005-2006**      **Senior Scientist** and **permanent staff** of the **Sino-French laboratory LIAMA** (Laboratory of Computer Sciences, Automation and Applied Mathematics, hosted by the Institute of Automation Chinese Academic of Sciences, Beijing, PR China; <http://liama.ia.ac.cn> ).
- 1995-2005**      **Co-head** of the « Integrative Tree Biomechanics » team at the Laboratory of Wood Rheology (**LRBB**, Joint Research Unit CNRS-INRA-Univ. Bordeaux I, Bordeaux, France).  
**Member** of the LRBB Scientific Cell.
- Since 1995**      **Research Scientist** at the **AMAP** Unit, CIRAD-AMIS (Montpellier, France)

## MAIN RESEARCH TOPICS

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### **Modelling tree growth and tree biomechanics:**

This activity aims to study the biomechanical response of trees to external forces. This research is mainly carried out based on simulation approaches at the plant scale and considering both short time scales, where tree structure can be considered as static, and long time scales where growth processes must be taken into consideration. This research topic includes questions about: 1- tree wind-firmness, e.g. crown-wind and root-soil mechanical interactions; 2- tree growth acclimation to external stimulus, e.g. formation of reaction wood involved in gravi- or photo-tropism; 3- dynamical feedback between shoot bending and ramification in fruit trees and bushes.

### **Eco-engineering of slope stability:**

Root-soil mechanical interactions are also involved in the reinforcement of slopes against erosion and shallow landslides. Finite element models integrating root architectural and biomechanical components have been developed and integrated at the slope scale in order to estimate its factor of safety.

## PROJECT COORDINATION

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- 2013-2017** *RoSoM - Influence of root-soil mechanical interaction on the variability of root architecture* (133 kEuros, Agropolis Fondation N°1202-073, <http://www.agropolis-fondation.fr/>); Main partners: UMR LMGC CNRS, Montpellier, France; UMR IATE INRA, Montpellier, France; UMR AGAP CIRAD, Montpellier, France; UMR Eco&Sols INRA, Montpellier, France; UMR PMMH, ESCPI, Paris, France; James Hutton Institute, Dundee, UK
- 2013-2017** *TAFER - Revegetation trajectories on railway and road embankments* (397 kEuros, Agropolis Fondation N°1200-014, <http://www.agropolis-fondation.fr/> and Labex CeMEB). Main partners: SYSTRA, Paris, France.
- 2011-2014** *Modélisation des relations structure-fonctions chez le Tectona grandis (Teck) de plantation en vue d'estimer et d'optimiser la qualité du bois* (AIRD Bourse de thèse CIRAD Sud). Coordination in Togo : Prof Kouami Kokou.
- 2011-2012** *Tecksim - Modélisation et simulation pour les ressources naturelles : étude et modélisation des relations structure-fonctions chez le Teck de plantation (Tectona grandis) pour l'estimation et l'optimisation de la qualité du bois en relation avec l'environnement* (20 kEuros, PCSI AUF). Coordination in Togo : Prof Kouami Kokou.
- 2011-2012** *Variabilité phénotypique des systèmes racinaire : focus sur les interactions mécaniques sol-racines* (4 kEuros, projet innovant INRA-EFPA). Main partners : UMR LMGC CNRS, Montpellier, France.
- 2008-2011** *Modélisation du renforcement des sols en pente par la végétation : aspects hydrauliques* (bourse de thèse en alternance Chine-France, French Embassy in China). Partner : Beijing Forestry University, China.
- 2008-2010** *Analyse de la stabilité d'une pente forestière* (120 kEuros, RTRA Agropolis Fondation).
- 2009-2010** *PlantBioM.lib - Development of a toolbox for the modelling and simulation of retroactions between plant growth and plant biomechanics* (22 kEuros, RTRA Agropolis Fondation).
- 2009** *Workshop on "Tree stability: models standardisation and integration"* (6 kEuros, RTRA & University Montpellier 2).
- 2007-2008** *ECOPENTE : « ECO-ingénierie pour la stabilisation des PENTES dans le Sud de la Chine : mieux connaître la biomécanique des plantes et la biodiversité pour prévenir et réduire les glissements de terrain »* (Programme CNRS Eco-ingénierie). Coordination leader Dr Nick Rowe, CNRS UMR AMAP, Montpellier, France.
- 2001-2004** *Echelle arbre : architecture, mécanique et stabilité du pin maritime* (programme Forêt, Vent et Risque, GIP ECOFOR). UMR LRBB, Bordeaux, France.
- 2001-2004** *VENFOR : les interactions entre vent et forêt, de l'échelle de l'arbre à celle du paysage* (programme Forêt, Vent et Risque, GIP ECOFOR). Coordination leader Yves Brunet, INRA UR EPHYSE, Bordeaux, France.

## PARTICIPATION IN OTHER PROJECTS

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- 2016-2019** *ECOPICS – Underground ecosystem services produced by plant communities along altitudinal gradients in France and Mexico* (Bilateral ANR PCRI, France-Mexico). Coordination Dr Alexia Stokes, INRA UMR AMAP, France.
- 2015-2018** *TERRE - Training Engineers and Researchers to Rethink geotechnical Engineering for a low carbon future* (H2020-MSCA-ITN UE N° 675762, <http://www.terre-etn.com/>). Coordination Prof Alessandro Tarantino, University of Strathclyde, Glasgow, UK.
- 2013-2016** *ECOSFIX – Root Ecosystem Services - Water Redistribution, Carbon Sequestration and Soil Settlement* (ANR-10-STRA-0003, Ecosystèmes, territoires, ressources vivantes et agricultures, SYSTERRA, 2010). Coordination Dr Alexia Stokes, INRA UMR AMAP, Montpellier, France.
- 2013-2016** *TWIST - Tree response to wind storm* (ANR Jeunes Chercheurs). Coordination Dr Pauline Defossez, INRA UR EPHYSE, Bordeaux, France.
- 2013-2016** *FOR-WIND - Adaptation sylvicole et économique de l'aménagement forestier au risque vent* (ANR). Coordination Dr Mériem Fournier, INRA UMR Lerfob, Nancy, France.
- 2011-2014** *Modélisation de l'ancrage racinaire du pin maritime et analyse numérique de l'effet de la teneur en eau des sols sur la résistance au chablis en podzol landais* (INRA & Région Aquitaine). Coordination Dr Pauline Defossez, INRA UR EPHYSE, Bordeaux, France.
- 2010-2013** *Rhizopolis – A federative project for plant root research* (Agropolis Fondation CfP 2010-GFP). Coordination Dr Alain Gojon, INRA UMR BPMP, Montpellier, France.
- 2011-2012** *Utilizing Space Age Digital Strain Measurement Technology to Identify Zones of Mechanical Weakness in Trees* (John Z. Duling Grant Program). Coordination Dr Gary Watson, Morton Arboretum, Lisle, Illinois, USA. Partner: NASA.
- 2010-2012** *CATARS - Caractérisation des Traits Architecturaux de systèmes Racinaires impliqués dans les processus de stabilisation des Sols* (Axe Ingénierie Ecologique CNRS-CEMAGREF). Coordination Dr Franck Bourrier, CEMAGREF Grenoble, France.
- 2010-2011** *Vers une intégration de processus biophysiques (lumière et biomécanique) dans le modèle GreenLab pour l'étude de la plasticité architecturale des arbres* (AAP INRA-INRIA). Coordination Dr Patrick Heuret, INRA UMR AMAP, Montpellier, France.
- 2010-2011** *Longitudinal and tangential growth stress in Eucalyptus: consequences on log-end cracks* (CNRS-CNICT Chili PHGXA78826). Coordination Dr Bruno Clair, CNRS UMR LMGC, Montpellier, France.
- 2001-2004** *Eco-engineering and conservation of slopes for long-term protection from erosion, landslides and storms (ECOSLOPES)* (UE FP5-LIFE QUALITY, QLK5-CT-2001-00289). Coordination Dr Alexia Stokes, INRA UMR LRBB, Bordeaux, France.
- 2001-2004** *Etude de l'ancrage racinaire des peupliers* (programme Forêt, Vent et Risque, GIP ECOFOR). Coordination Christophe Drénou, IDF, Toulouse, France.

## MAIN PhD THESIS SUPERVISION

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- Fraccica Alessandro, since 2017.** *Modeling the dynamics of root reinforcement for stabilisation of cut slopes.* Joint convention between Université de Montpellier and Universitat Politècnica de Catalunya, Barcelone, Espagne (co-supervision Prof Romero Enrique).
- Dainese Roberta, since 2017.** *The use of vegetation for short term hydrological control of suction.* Joint convention between Université de Montpellier and Strachlyde University (co-supervision Prof Tarantino Alessandro)
- Fakih Mahmoud, 2013-2016.** *Modélisation numérique discrète de la croissance racinaire dans un sol : relation force-forme.* Thèse de l'Université de Montpellier, France (co-direction Dr Radjai Farhang, MIT-CNRS).
- Tondjo Kodjo, 2012-2016.** *Analyse et Modélisation des relations structure-fonctions chez le Teck (Tectona grandis) de plantation au Togo.* Université de Lomé, Togo (co-supervision Dr Kokutse Adzo Dzifa).
- Yang Ming, 2011-2014.** *Tree root anchorage : modelling and numerical analyses of key contributing factors of wind firmness of Pinus pinaster.* Université de Bordeaux, France (co-supervision Dr Defossez Pauline, INRA UMT ISPA).

- Bonneu Adrien, 2008-2011.** *Développement d'un modèle continu d'enracinement basé sur l'agrégation de l'architecture racinaire des plantes.* Université de Montpellier, France (co-supervision Prof Langlais Michel, Université de Bordeaux).
- Ji Jinnan, 2008-2011.** *Modélisation et analyse par éléments finis de l'effet de la végétation sur la stabilité des pentes en zones forestières.* Université de Montpellier, France (co-supervision Prof Zhang Zhiqiang, Beijing Forestry University, Pékin, Chine).
- Guillon Thomas, 2008-2011.** *Modélisation mathématique, simulation numérique et contrôle optimal des rétroactions entre biomécanique et croissance de l'arbre.* Université de Montpellier, France.
- Jin Xiuhong, 2007-2010.** *Modeling and analyzing of lodging based on biomechanical and architectural properties of high-yield hybrid rice* (written in Chinese). Chinese Agricultural University, Beijing, China (co-supervision Prof Guo Yan).
- Kokutse Nomessi Kuma, 2005-2008.** *Modélisation du renforcement des sols et analyse numérique de l'impact de la structure des peuplements forestiers sur la stabilité des pentes. Applications à l'éco-ingénierie.* Université de Bordeaux 1, France.
- Sellier Damien, 2001-2004.** *Analyse numérique du comportement mécanique d'arbres sous sollicitation aérodynamique turbulente.* Université de Bordeaux 1, France (co-supervision Dr Brunet Yves, INRA UR EPHYSE).
- Dupuy Lionel, 2000-2003.** *Modélisation de l'ancrage racinaire des arbres forestiers.* Université de Bordeaux 1, France (co-supervision Dr Stokes Alexia, INRA UMR LRBB).
- Ancelin Philippe, 1998-2001.** *Modélisation du comportement biomécanique de l'arbre dans son environnement forestier : application au pin maritime.* Université de Bordeaux 1, France (co-supervision Dr Castéra Patrick, INRA UMR LRBB).

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#### INTERNATIONAL ARTICLES

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- Jackson T, Shenkin A, Moore J, Bunce A, van Emmerik T, Kane B, Burcham D, James K, Selker J, Calders K, Origo N, Disney M, Burt A, Wilkes P, Raunonen P, Gonzalez de Tanago Menaca J, Lau A, Herold M, Goodman RC, **Fourcaud T**, Malhi Y (2019) An architectural understanding of natural sway frequencies in trees. *Journal of The Royal Society Interface* 16:20190116. doi: 10.1098/rsif.2019.0116
- Fakih M, Delenne JY, Radjai F, **Fourcaud T** (2019) Root growth and force chains in a granular soil. *Physical Review E*, 99 (4) : 042903.
- Jackson T, Shenkin A, Wellpott A, Calders K, Origo N, Disney M, Burt A, Raunonen P, Gardiner B, Herold M, **Fourcaud T**, Malhi Y (2019) Finite element analysis of trees in the wind based on terrestrial laser scanning data. *Agricultural and Forest Meteorology*, 265 : 137-144.
- Tondjo, K. , Brancheriau, L., Sabatier, S.-A., Kokutse, A. D., Kokou, K., Jaeger, M., de Reffye, P., Fourcaud, T., 2018. Stochastic modelling of tree architecture and biomass allocation: application to teak (*Tectona grandis* L. f.), a tree species with polycyclic growth and leaf neof ormation. *Annals of Botany*, 121 (5) : 1397-1410.
- Yang M, Défossez P, Danjon F, **Fourcaud T** (2018) Analyzing key factors of roots and soil contributing to tree anchorage of *Pinus* species. *Trees - Structure and Function*, 32 (3) : 703-712.
- Bares J, Mora S, Delenne JY, **Fourcaud T** (2017) Experimental observations of root growth in a controlled photoelastic granular material. *EPJ Web of Conferences* , 140 : 1-4.
- Fakih M, Delenne JY, Radjai F, **Fourcaud T** (2017) Modeling root growth in granular soils: effects of root stiffness and packing fraction. *EPJ Web of Conferences* , 140 (14013) : 1-4.
- Kim JH, **Fourcaud T**, Jourdan C, Maeght J-L, Mao Z, Metayer J, Meylan L, Pierret A, Rapidel B, Roupsard O, de Rouw A, Sanchez MV, Wang Y, Stokes A (2017). Vegetation as a driver of temporal variations in slope stability: The impact of hydrological processes. *Geophysical Research Letters*, 44 doi:10.1002/2017GL073174.

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† Names of PhD students under my supervision are underlined

- Yang M, Défossez P, Danjon F, Dupont S, **Fourcaud T** (2017). Which root architectural elements contribute the best to anchorage of coniferous species? Insights from in silico experiments. *Plant and Soil*, 411 (1) : 275-291.
- Fakih M, Delenne JY, Radjai F, **Fourcaud T** (2016) Contribution of mechanical factors to the variability of root architecture: Quantifying the past history of interaction forces between growing roots and soil grains. 2016 IEEE International Conference on Functional-Structural Plant Growth Modeling, Simulation, Visualization and Applications (FSPMA), pp 52-60. DOI: 10.1109/FSPMA.2016.7818288
- Peynaud E, **Fourcaud T**, Dumont Y (2016) Numerical resolution of the C-root model using Discontinuous Galerkin methods on unstructured meshes: Application to the simulation of root system growth. 2016 IEEE International Conference on Functional-Structural Plant Growth Modeling, Simulation, Visualization and Applications (FSPMA), pp 158-166. DOI: 10.1109/FSPMA.2016.7818302.
- Tondjo K, Brancheriau L, Sabatier S-A, Kokutse AD, Akossou A, Kokou K, **Fourcaud T** (2015). Non-destructive measurement of leaf area and dry biomass in *Tectona grandis*. *Trees - Structure and Function*, 29 (5) : 1625-1631.
- Tondjo K, Brancheriau L, Sabatier S-A, Kokutse AD, Akossou A, Kokou K, **Fourcaud T** (2015). Is the variability of key wood properties linked with the variability of key architectural traits? Case of planted Teak in Togo regarding thinning and provenance. *Annals of Forest Science*, 72 (6) : 717-729.
- Mauriat M, Le Provost G, Rozenberg P, Delzon S, Breda N, Clair B, Coutand C, Domec JC, **Fourcaud T**, Grima-Pettenati J, Herrera R, Leplé JC, Richet N, Trontin JF, Plomion C (2014). Wood formation in trees. In Ramawat, K. G., Merillon, J. M., Ahuja, M. R. (Eds) *Tree biotechnology*. Boca raton : CRC Press
- Fourcaud T**, Kang MZ, Dumont Y, Guo Y (2014) Editorial of the Special Issue of the 4th International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications (PMA'12). *Ecological Modelling*. 290 : 1-2.
- Mao Z, Bourrier F, Stokes A, **Fourcaud T** (2014) Three dimensional modelling of slope stability in heterogeneous montane forest ecosystems. *Ecological Modelling*. 273: 11-22.
- Mao Z, Yang M, Bourrier F, **Fourcaud T** (2014) Evaluation of root reinforcement models using numerical modelling approaches. *Plant and Soil*. 381 (1) : 249-270.
- Stokes A, Douglas G, **Fourcaud T**, Giadrossich F, Gillies C, Hubble T, Kim JH, Loades K, Mao Z, McIvor I, Mickovski SB, Mitchell S, Osman N, Phillips C, Poesen J, Polster D, Preti F, Raymond P, Rey F, Schwarz M, Walker L R (2014) Ecological mitigation of hillslope instability: ten key issues facing researchers and practitioners. *Plant and Soil*. 377 (1) : 1-23.
- Yang M, Défossez P, Danjon F, **Fourcaud T** (2014) Tree stability under wind: simulating uprooting with root breakage using a finite element method. *Annals of Botany*. 114 (4) : 695-709.
- Bourrier F, Kneib F, Chareyre B, **Fourcaud T** (2013) Discrete modeling of granular soils reinforcement by plant roots. *Ecological Engineering*. 61: 646-657.
- Yang M, Défossez P, **Fourcaud T** (2013). Improving finite element models of roots-soil mechanical interactions. In Nikinmaa, E., Nygren, P., Sievänen, R., Godin, C., Lintunen, A. (Eds) *Proceedings of the 7th International Conference on Functional Structural Plant Models*, Saariselka, Finland, 9-14 June 2013. Vantaa : Finnish Society of Forest Science, 204-206 p.
- Bonneu A, Dumont Y, Rey H, Jourdan C, **Fourcaud T** (2012) A minimal continuous model for simulating root growth and development of plant root systems. *Plant and Soil*. 354(1): 211-227
- Fourcaud T**, Guillon T, Dumont Y (2012) Simulation of tree branch motion. In Guo, Y., Kang, M. Z., Dumont, Y. (Eds) *Plant growth modeling, simulation, visualization and applications. Proceedings PMA12 : The Fourth International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications*, Shanghai, China, 31 October-3 November 2012. Beijing : IEEE Press, 117-124 p.
- Guillon T, Dumont Y, **Fourcaud T** (2012) Numerical methods for the biomechanics of growing trees. *Computers And Mathematics With Applications*. 64(3): 289-309.
- Guillon T, Dumont Y, **Fourcaud T** (2012) A new mathematical framework for modelling the biomechanics of growing trees with rod theory. *Mathematical and Computer Modelling*. 55(9): 2061-2077
- Ji JN, Kokutse N, Genet M, **Fourcaud T**, Zhang ZQ (2012) Effect of spatial variation of tree root characteristics on slope stability. A case study on Black Locust (*Robinia pseudoacacia*) and Arborvitae (*Platycladus orientalis*) stands on the Loess Plateau, China. *Catena* 92: 139-154
- Fourcaud T**, Guillon T, Dumont Y (2011) Biomechanics of growing trees: mathematical model, numerical resolution and perspectives. In: Simos TE, Psihoyios G, Tsitouras C, Anastassi Z (eds) *9th International Conference of*

Numerical Analysis and Applied Mathematics - ICNAAM 2011, vol 1389(1). AIP Conference Proceedings, Halkidiki, Greece, pp 734-737

- Genet M, Li MC, Luo TX, **Fourcaud T**, Clement-Vidal A, Stokes A (2011) Linking carbon supply to root cell-wall chemistry and mechanics at high altitudes in *Abies georgei*. *Annals of Botany* 107: 311-320
- Guo Y, **Fourcaud T**, Jaeger M, Zhang X, Li B (2011) Plant growth and architectural modelling and its applications. *Annals of Botany* 107: 723-727
- Mickovski S. B., Stokes A., van Beek L. P. H., Ghestem M. and **Fourcaud T**. (2011) Simulation of direct shear tests on rooted and non-rooted soil using Finite Element analysis. *Ecological Engineering* 37 (10): 1523-1532.
- Ba MD, Salin F, **Fourcaud T**, Stokes A (2010) Reorientation strategies in leaning stems of young Maritime pine (*Pinus Pinaster*) and Loblolly pine (*Pinus taeda*). *Iawa J.* 31: 465-480
- Bonneu A, **Fourcaud T**, Ducrot A, Langlais M (2010) Proposition of a conceptual density based model to describe fine root networks in tree root systems. In: Jaeger M, Li BG (eds) PMA06 - Plant Growth Modelling and Applications, IEEE Computer Society, Los Alamitos, California, pp 18-25
- Genet M, Stokes A, **Fourcaud T**, Norris JE (2010) The influence of plant diversity on slope stability in a moist evergreen deciduous forest. *Ecological Engineering* 36: 265-275
- Herrera R, Krier C, Lalanne C, Ba EH, Stokes A, Salin F, **Fourcaud T**, Claverol S, Plomion C (2010) (Not) Keeping the stem straight: a proteomic analysis of maritime pine seedlings undergoing phototropism and gravitropism. *BMC Plant Biology* 10: 217
- Jin XH, **Fourcaud T**, Li BG, Guo Y (2010) Towards modeling and analyzing stem lodging for two contrasting rice cultivars. In: Jaeger M, Li BG (eds) PMA06 - Plant Growth Modelling and Applications, IEEE Computer Society, Los Alamitos, California, pp 253-260
- Sellier D, **Fourcaud T**. 2009. Crown structure and wood properties : Influence on tree sway and response to high winds. *American Journal of Botany*, 96 : 885-896.
- Brunet Y, Dupont S, Sellier D, **Fourcaud T** (2009) Les interactions vent-arbre, de l'échelle locale à celle du paysage : vers les approches déterministes. In Birot, Y., Landmann, G., Bonhême, I. (Eds) *La forêt face aux tempêtes*. Paris : Ed. Quae, 229-259 p. (Synthèses).
- Stokes A, Atger C, Bengough AG, **Fourcaud T**, Sidle RC (2009) Desirable plant root traits for protecting natural and engineered slopes against landslides. *Plant and Soil* 324: 1-30
- Abd. Ghani M, Stokes A, **Fourcaud T**. 2008. The effect of root architecture and root loss through trenching on the anchorage of tropical urban trees (*Eugenia grandis* Wight). *Trees-Structure and Function*, 23 : 197-209.
- Fourcaud T.**, Zhang X-P., Stokes A., Lambers H., Körner C. 2008. Plant growth modelling and applications: the increasing importance of plant architecture in growth models. *Annals of Botany*, 101: 1053-1063.
- Barczy J.-F., Rey H., Caraglio Y., De Reffye P., Barthelemy D., Dong Q.X., **Fourcaud T**. 2008. AmapSim: a structural whole-plant simulator based on botanical knowledge and designed to host external functional models. *Annals of Botany*, 101: 1125-1138.
- Fourcaud T.**, Ji J.N., Zhang Z.Q., Stokes A. 2008. Understanding the impact of root morphology on overturning mechanisms: a modelling approach. *Annals of Botany*, 101: 1267-1280.
- Genet M., Kokutse N., Stokes A., **Fourcaud T.**, Cai X-H., Ji J-N. 2008. Root reinforcement in plantations of *Cryptomeria japonica* D. Don: effect of tree age and stand structure on slope stability. *Forest Ecology and Management*, 256: 1517-1572.
- Sellier D., Brunet Y., **Fourcaud T**. 2008. A numerical model of tree aerodynamic response to a turbulent air flow. *Forestry*, 81:279-297.
- Stokes A, Norris JE, van Beek LPH, Bogaard T, Cammeraat E, Mickovski SB, Jenner A, di Iorio A, **Fourcaud T**. 2008. How vegetation reinforces soil on slopes. In: Norris JE, Stokes A, Mickovski SB, Cammeraat E, van Beek LPH, Nicoll B, Achim A, eds. *Slope stability and erosion control: ecotechnological solutions*. Dordrecht: Springer, 65-118.
- Dupuy L., **Fourcaud T.**, Lac P., Stokes A., 2007, A generic 3D finite element model of tree anchorage integrating soil mechanics and real root system architecture, *American Journal of Botany*, 94 (9): 1506-1514.
- Sellier D., **Fourcaud T.**, Lac P., 2006, A finite element model for investigating effect of aerial architecture on tree oscillations, *Tree Physiology*, 26:807-817.

- Fournier M., Stokes A., Coutand C., **Fourcaud T.**, Moulia B., 2006, Tree biomechanics and growth strategies in the context of forest functional ecology. In: biomechanics : a mechanical approach to the ecology of animals and plants, Eds A. Herrel, T. Speck, N. Rowe, CRC Press, LLC (USA), 1-34.
- Dupuy L., **Fourcaud T.**, Stokes A., 2005, A numerical investigation into the influence of soil type and root architecture on tree anchorage, *Plant and Soil*, 278:119-134
- Danjon F., **Fourcaud T.**, Bert D., 2005, Root architecture and windfirmness of mature *Pinus pinaster* Ait., *New Phytologist*, 168(2):387-400
- Genet M., Stokes A., Salin F., Mickovski S.B., **Fourcaud T.**, Dumail J-F., van Beek R., 2005, The influence of cellulose content on tensile strength in tree roots, *Plant and Soil*, 278:1-9
- Dupuy L., **Fourcaud T.**, Stokes A., Danjon F., 2005, A density based approach for the modelling of root architecture: application to Maritime pine (*Pinus pinaster* Ait.) root systems, *Journal of Theoretical Biology*, 236(3):323-34
- Stokes A., Salin F., Kokutse A.D., Berthier S., Jeannin H., Mochan S., Dorren L., Kokutse N.K., **Fourcaud T.**, 2005, Mechanical resistance of different tree species to rockfall in the French Alps I: quantifying the mode of failure through tree mapping and winching experiments, *Plant and Soil*, 278:107-117
- Sellier D., **Fourcaud T.**, 2005, Relationship between the oscillations of young pines (*Pinus pinaster* Ait.) and their aerial architecture, *J Exp Bot*, 56(416):1563-1573
- Tamasi E., Stokes A., Lasserre B., Danjon F., Berthier S., **Fourcaud T.**, Chiatante D., 2005, Influence of wind loading on root system development and architecture in oak (*Quercus robur* L.) seedlings , *Trees*, 19 : 374-384.
- Ancelin P., Courbaud B., **Fourcaud T.**, 2004, Developing an individual tree based mechanical model to predict wind damage within forest stands, *Forest Ecol Manag*, 203:101-121
- Ancelin P., **Fourcaud T.**, Lac P., 2004, Modelling the biomechanical behaviour of growing trees at the forest stand scale. Part I: development of an Incremental Transfer Matrix Method and application on simplified tree structures, *Ann. For. Sci.*, 61: 263-275
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- Fourcaud T.**, Lac P., 2003, Numerical modelling of shape regulation and growth stresses in trees PART I : an incremental static finite element formulation, *Trees*, 17:23-30.
- Fourcaud T.**, Blaise F., Lac P., Castera P., de Reffye P., 2003, Numerical modelling of shape regulation and growth stresses in trees PART II : implementation in the AMAPpara software and simulation of tree growth, *Trees*, 17:31-39
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#### BOOK EDITION

- Fourcaud T.**, Zhang X-P. 2007. PMA06 Second Symposium on Plant Growth Modeling, Simulation Visualization and Applications. IEEE Computer Society: Los Alamitos Cal.

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#### INVITED SPEAKER

- Invited conference on « L'UMR AMAP : plus de trente ans d'expérience de recherche interdisciplinaire en modélisation de l'architecture des plantes » at **colloque CIRUISEF – La Recherche Scientifique et ses Interfaces Disciplinaires**, 23-27 mai 2016, Marseille, France.
- Invited conference on “Tree architecture: a major component of tree growth models”, at the **Colloquium “Forest Biometrics and Computer Science“**, 17th October 2013, University of Göttingen, Germany.
- Invited conference on “Is Biomechanics an Important Component of Tree Architecture?”, at the **7<sup>th</sup> International Conference on Plant Biomechanics**, 20-24 August 2012, Clermont Ferrand, France.
- Invited conference on “Models & software for simulating plant architecture and applications”, at the **workshop "Modelling tree crown architecture for wood quality prediction"**, 6-7 Juin 2011, Alberta University, Canada.
- Invited conference on “Numerical modelling of root-soil interaction”, at the **international conference on eco-engineering: the use of vegetation to improve slope stability**, 13-17 September 2004, Thessaloniki, Greece.
- Invited conference on “Growth stresses and tree shape”, at the **Third International Conference of the European Society for Wood Mechanics**, ESWM 2004, 5th to 8th September 2004, Vila Real, Portugal.
- Invited conference on "Sylviculture virtuelle: simulation de la croissance des arbres et de la qualité du bois", at the **Colloque National de la Recherche en IUT**, IUT de Tarbes, 15 mai 2003.
- Invited conference on “A finite element model to simulate the biomechanical behaviour of trees”, **Workshop Finite Element Modelling: From the Tree-Level to the Board-Level**, 30 January 2002, FRI, Rotorua, New Zealand.

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#### OTHER ACTIVITIES

##### Member of Scientific Councils

**Since 2017**      SC member of INRA Applied Mathematics and Computer Sciences (MIA) Department



## Member of International Scientific Committees (SC) and Organizing Committees (OC) :

*Powder&Grains 2017, Montpellier, France* <http://www.pg2017.org/en/>, (OC)

*FSPMA2016, Qingdao, China,* <http://fspma2016.csp.escience.cn/dct/page/1>, (CS)

*Ecosummit 2016, Montpellier, France,* <http://www.ecosummit2016.org/>, (OC)

*4th International Conference Soil Bio- and Eco-Engineering: The Use of Vegetation to Improve Slope Stability, 11-15 Juillet 2016, Sydney, Australie,*  
<http://sydney.edu.au/science/geosciences/soil/index.shtml> (CS)

*IUFRO 2014 Wind and Trees International Conference, 03-08 August 2014, Sao Paulo, Brazil,*  
<http://fealq.org.br/iufro-2014-wind-and-trees-international-conference/> (CS)

*FSPM13 7th International Conference on Functional–Structural Plant Models, 9-14 June 2013, Saariselkä, Finland,* <http://www.metla.fi/fspm2013/> (CS)

*3rd International Conference on Soil Bio- and Eco-Engineering - the Use of Vegetation to Improve Slope Stability, 23-27 July 2012, Vancouver, Canada,*  
<http://www.waswac.org/newsShow.asp?id=251&fileSort=20> (CS)

*PMA12 The third International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications, November 2012, ShangHai, China,* <http://pma.cirad.fr/PMA12/index.html> (CS)

*FSPM10 6th International Conference on Functional–Structural Plant Models, 12-17 September 2010, UC Davis, USA,* <http://www.plantsciences.ucdavis.edu/symposium/2010/fspm/> (CS)

*PMA09 The third International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications, 09-13 November 2009, Beijing, China,*  
<http://pma.cirad.fr/PMA09/Organization.htm> (CS)

*Second International Conference on Eco-engineering: the use of vegetation to improve slope stability, 20-24 July 2008, Beijing, China* (OC, CS)

*FSPM07 5<sup>th</sup> International Workshop in Structural-Functional Plant Models, 4-9 November 2007, Napier, New Zealand,* <http://algorithmicbotany.org/FSPM07/> (CS)

**Chair of PMA06** *The Second International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications, 13-17 November 2006, Beijing, China* (Chair, OC, CS)

*The Supporting of Trees and Woody Plants: Form, Function and Physiology, International Conference, 20-24 juillet 1998, Bordeaux, France* (OC, CS)

*4<sup>th</sup> International Workshop in Structural-Functional Plant Models, 7-11 June 2004, Montpellier, France* (CS)

*First International Conference on Eco-engineering: the use of vegetation to improve slope stability, 13-17 September 2004, Thessaloniki, Greece* (CS)

## Member of International Boards

**Since 2007** Deputy Coordinator of *IUFRO Group 8.03.06 - Impact of wind on forests* (<http://www.iufro.org/science/divisions/division-8/80000/80300/80306/>)

**Since 2008** Member of the Editorial Board *Trees –Structure and Function:* <http://www.springerlink.com/content/100387/>

**2006-2011** Member of the Editorial Board *AoB – Plants* : <http://aobpla.oxfordjournals.org/>

## Invited Editor

Special Issues of :

PMA12 : <http://www.sciencedirect.com/science/journal/03043800/290> in Ecological Modelling

PMA09: <http://aob.oxfordjournals.org/content/107/5.toc> in Annals and Botany

PMA06 : <http://aob.oxfordjournals.org/content/101/8.toc> in Annals of Botany

## Teaching

**2001-2005** In charge of the **Wood Sciences DEA optional module** « Tree biomechanics : concepts and modelling» at the Bordeaux I University, France.

**Since 2000** **Professional Workshop** : "Tree biomechanics", Bordeaux, France.

**Since 1996** **Course at the Engineering School ENITA** Bordeaux: "The AMAP software".

## Professional Training

**2009-2012** « *L'arbre face au vent* » organised by Atelier de l'Arbre », Montpellier.

**2012** « *Tree Risk Assessment : The Biomechanics of Stability, Strength, and Structure* », organised by ISA – International Society of Arboriculture, Morton Arboretum, Lisle, Illinois, USA, September 24–25, 2012.

**2011** « *Biomechanics of the trees* » SOI Advanced Course, Florence, Italy, 21-26 June 2011.