University of Limoges

Damien André

Born in 1978, married, two children, french

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Associate professor
Limoges University & Ceramic Research Institute

Overview of research activities

Since my PhD, defended in 2012, my research activities are mainly involved in numerical methods for applied mechanics dedicated to brittle materials. I co-develop original numerical methods, algorithms and models within the discrete element framework named *GranOO* in order to improve the understanding and the prediction of the microstructure / macroscopic properties relationships of ceramics and, more specifically, refractory materials using thermo-mechanical and multi-scale numerical approaches.

Key numbers

publication in peer reviewed journals	19	scientific book	2
codirection of PhD (*3 defended*)	7	supervision of master student	9
invited international conference (*2 as speaker*)	6	invited seminary (*2 international*)	7
international conference (*5 as speaker*)	29	national conference (*5 as speaker*)	18

Professional experiences

2014 ➠ Now	Associate professor at the Ensil-Ensci engineering school of the University of Limoges and permanent researcher at the CERamic Research Institute (Ircer) - *Limoges city (Fr)*
2012 ➠ 2014	PostDoc, A quantitative numerical model of free abrasive grinding Arts & Métiers ParisTech - institute of mechanical engineering (I2m) - *Talence city (Fr)*
2008 ➠ 2012	PhD, A discrete element model to investigate sub-surface damage due to surface polishing University of Bordeaux - Lamefip laboratory - *Talence city (Fr)*
2003 ➠ 2008	High school teacher - Mechanical engineering courses French Ministry of National Education - *Grenoble and Dieppe cities (Fr)*

Academic progress

June 2008	Certification of equivalence for the Master degree - research proposal based on activities related to the development of the Openmeca software - University Bordeaux 1
1997 ➠ 2001	Deug - Licence and 4th year diploma of mechanical technologies - University Bordeaux 1
2001 ➠ 2003	Intensive preparation for the french high school teacher diploma - University Bordeaux 1

Teaching & lessons

PhD level	Data science & introduction to machine learning with the Python language	(*lecture & practical*)
master level	Simulation of ceramic processes and materials using DEM	(*lecture & practical*)
master level	Continuum solid mechanics and material strength theory of brittle materials	(*lecture & practical*)
license level	Introduction to Python language for data science	(*lecture & practical*)
license level	Introduction to machine learning with Python	(*lecture & practical*)
license level	Practical work in 3D CAD modeling	(*practical only*)
license level	Practical work in automatism	(*practical only*)

Collective responsibilities

2021 ➠ now	Member of the steering committee of the joint CEA/IRCER research laboratory (LRC-ELECTRA)
2019 ➠ 2020	Member of the steering committee of the Ensil-Ensci engineering school (~ 800 students)
2018 ➠ now	Coordinator team of the Ircer's website
2018 ➠ now	Communication manager of the Ircer's Axe 4 group
2015 ➠ now	Supervisor of the 2nd year students of the Ensil-Ensci engineering school (~ 50 students)
2012 ➠ now	Administrator of the (open source) discrete element platform GranOO

Research projects

2022 ➠ 2027 — Concerted European action on Sustainable Applications of REFractories
CESAREF — European industrial doctoral network - 8 academics and 9 industrial partners
International project - 15 PhDs

2020 ➠ 2023 — Micromechanical behaviour of nanostructured oxides at very high temperature
HOTMIX — French and german collaboration ANR/DFG support - 6 academic partners
International project - 4 PhDs and 2 postDocs

2020 ➠ 2023 — Ceramic processes and microstructure for highly dynamic application
CAPRIC-DYN — Nouvelle Aquitaine region support - 2 academics and 1 industrial partner
National project - 2 PhDs and 2 postDocs

2017 ➠ 2021 — Advanced thermomechanical multiscale modelling of refractory linings
ATHOR — European project Marie Curie ETN - 7 academics and 8 industrial partners
International project - 15 PhDs

2016 ➠ 2020 — Thermomechanical modelling from material microstructure to lining validation
DELTA — Consortium within the FIRE association - 4 academics and 7 industrial partners
International project - 4 PhDs

PhD co-directions

2023 ➠ 2026 — Discrete Element Method to support microstructure design of refractories - Harikeshava RANGANATHAN
CESAREF — - Europe IDN project funding

2022 ➠ 2025 — Characterization and modeling by discrete elements of the sintering of ceramic parts made by
ELECTRA — additive manufacturing - Aya BENJIRA - Electra funding

2020 ➠ 2023 — Thermomechanical modelling by the discrete element method of thermal shock on model refractory
HOTMIX — materials - Quentin PLEDEL - ANR/DFG funding

2020 ➠ 2023 — Damage modeling of plasma sprayed ceramics under dynamic stresses using a discrete / continuous
CAPRIC-DYN — multiscale approach - Vincent LONGCHAMP - Region Nouvelle Aquitaine / CEA funding

2018 ➠ 2021 — Multiscale modeling of refractory lining - Micro-mechanical approach with the discrete element
ATHOR — method - Farid ASADI - Europe ETN project funding

2016 ➠ 2019 — Numerical modeling of microstructure-properties relationships of refractories: micro-mechanical
DELTA — approach with the discrete element method - Truong Thi NGUYEN - Region Limousin funding

2015 ➠ 2018 — Study of the influence of additives on the thermomechanical properties of carbon-bonded refractory
CIFRE — composites - Andrzej WARCHAL - Vesuvius company funding

Master supervisions

2022 — Characterization and modeling of the sintering of ceramic parts - A. BENJIRA
2021 — Discrete element modeling of the blast resistance of high performance concretes - M. ESTRADE
2020 — Open-hardware instrumentation of strain gauges - M. LOZACH
2019 — Discrete element model of failure in compression of refractory model material - Q. DELBLOND
2018 — 3D printing of glasses - C. DUPONT
2017 — Digital image correlation of in-situ micromechanical device - E. AUTEF
2016 — Modeling of densification processes during SPS sintering of model material - L. LEBDIOUA
2015 — Thermomechanical modeling using DEM of heteregenous materials - B. LEVRAUT
2014 — Optimisation of service life expanctacy of refractories using thermal treatments - A. POMAR

Publication in peer reviewed journals

Farid Asadi et al. "Advances in Micro-Mechanical Modeling Using a Bonded-Particle Model and Periodic Homogenization Within Discrete Element Framework Applied to Heterogeneous Ceramics". In: *Journal of the European Ceramic Society* (2022).

Farid Asadi et al. "Investigation of different discrete modeling strategies to mimic microstructural aspects that influence the fracture energy of refractory materials". In: *Open Ceramics* 11 (2022), p. 100288.

Farid Asadi et al. "Numerical modelling of the quasi-brittle behaviour of refractory ceramics by considering microcracks effect". In: *Journal of the European Ceramic Society* 42.3 (2022), pp. 1149–1161. ISSN: 0955-2219.

P Michaud et al. "Numerical prediction of elastic properties for alumina green parts printed by stereolithography process". In: *Journal of the European Ceramic Society* (2020).

A Ratsimba et al. "Densification behaviour and three-dimensional printing of Y2O3 ceramic powder by selective laser sintering". In: *Ceramics International* (2020).

Vinh DX Nguyen et al. "Discrete element method using cohesive plastic beam for modeling elasto-plastic deformation of ductile materials". In: *Computational Particle Mechanics* (2020), pp. 1–21.

MH Moreira et al. "Discrete element modeling—A promising method for refractory microstructure design". In: *American Ceramic Society Bulletin* 99.2 (2020), pp. 22–28.

Truong-Thi Nguyen, Damien André, and Marc Huger. "Analytic laws for direct calibration of discrete element modeling of brittle elastic media using cohesive beam model". In: *Computational Particle Mechanics* 6.3 (2019), pp. 393–409.

Damien André, Jérémie Girardot, and Cédric Hubert. "A novel DEM approach for modeling brittle elastic media based on distinct lattice spring model". In: *Computer Methods in Applied Mechanics and Engineering* 350 (2019), pp. 100–122.

Yasmine Lalau et al. "A method for experimental thermo-mechanical aging of materials submitted to concentrated solar irradiation". In: *Solar Energy Materials and Solar Cells* 192 (2019), pp. 161–169.

Yasmine Lalau et al. "IMPACT: A novel device for in-situ thermo-mechanical investigation of materials under concentrated sunlight". In: *Solar Energy Materials and Solar Cells* 172 (2017), pp. 59–65.

Cédric Hubert et al. "Simulation of continuum electrical conduction and Joule heating using DEM domains". In: *International Journal for Numerical Methods in Engineering* 110.9 (2017), pp. 862–877.

Damien André et al. "A discrete element thermo-mechanical modelling of diffuse damage induced by thermal expansion mismatch of two-phase materials". In: *Computer Methods in Applied Mechanics and Engineering* 318 (2017), pp. 898–916.

P Blaineau et al. "Subsurface mechanical damage during bound abrasive grinding of fused silica glass". In: *Applied Surface Science* 353 (2015), pp. 764–773.

Laurent Maheo et al. "A promising way to model cracks in composite using Discrete Element Method". In: *Composites Part B: Engineering* 71 (2015), pp. 193–202.

Damien André et al. "The GranOO workbench, a new tool for developing discrete element simulations, and its application to tribological problems". In: *Advances in Engineering Software* 74 (2014), pp. 40–48.

Mohamed Jebahi et al. "Simulation of Vickers indentation of silica glass". In: *Journal of Non-Crystalline Solids* 378 (2013), pp. 15–24.

Damien André et al. "Using the discrete element method to simulate brittle fracture in the indentation of a silica glass with a blunt indenter". In: *Computer Methods in Applied Mechanics and Engineering* 265 (2013), pp. 136–147.

Damien André et al. "Discrete element method to simulate continuous material by using the cohesive beam model". In: *Computer methods in applied mechanics and engineering* 213 (2012), pp. 113–125.

Books

Damien André, Jean-Luc Charles, and Ivan Iordanoff. *3D Discrete Element Workbench for Highly Dynamic Thermo-mechanical Analysis: GranOO*. John Wiley & Sons, 2015.

Mohamed Jebahi et al. *Discrete element method to model 3D continuous materials*. John Wiley & Sons, 2015.

Invited international conferences

Damien André et al. "DEM modelling to investigate the impact of microstructure on refractory". In: Perugia, Italy, June 2022.

Jérémie Girardot, Damien André, and Cédric Hubert. "Modeling brittle elastic media with polyhedral discrete element". In: *6th International Conference on Particle-Based Methods*. Barcelona, Spain, Oct. 2019.

Marc Huger, Nicolas Tessier-Doyen, and Damien André. "Relationship between microstructure and thermomechanical behaviour. Measurement of these properties and interpretation with the help of model materials". In: *Keynote Speech during Korea Refractory Symposium*. Seoul, South Korea, Oct. 2019.

Marc Huger, Nicolas Tessier-Doyen, and Damien André. "Multi-scale composite approach to effective thermal and mechanical properties of refractories: from grains to material level". In: *English Lecture during Wuhan Annual Symposium on Refractories*. Wuhan, China, Oct. 2019.

Damien André and J Girardot. "Overview of GranOO, a versatile opensource DEM code". In: *8th International Conference on Discrete Element Methods*. Twente, Netherlands, July 2019.

Marc Huger, Nicolas Tessier-Doyen, and Damien André. "Relationship between microstructure and thermomechanical behaviour. Measurement of these properties and interpretation with the help of model materials". In: *3rd Iranian Refractory Symposium 2017*. Tehran, Iran, Oct. 2017.

Invited seminaries & lectures

Damien André. "A discrete element model compatible with continuum mechanic constitutive laws". In: *3rd edition of the Severo Ochoa Seminars at CIMNE*. Barcelona, Spain, Sept. 2022.

Damien André. "Approche DEM (Discrete Elements Method) et logiciel GranOO". In: *Séminaire à l'Institut de radioprotection et de sûreté nucléaire*. Cadarache, France, May 2022.

Damien André. "Micromechanics using Discreet Element modelling". In: *ATHOR Refractory Training Course 2, Part 3*. Cavaillon, France, June 2019.

Damien André. "Modélisation par éléments discrets dans les procédés céramiques: application au refroidissement post-frittage". In: *Séminaire Journée Technique" Simulation et Modélisation pour les procédés céramiques"*. Labege, France, Oct. 2019.

Damien André. "Modélisation par élément discret de comportement élastique fragile: application aux microstructures céramiques". In: *Séminaire laboratoire Lamé*. Blois, France, Dec. 2018.

Damien André. "Une introduction au langage python". In: *Séminaire CSMA Junior*. Giens, France, May 2017.

Damien André. "A numerical approach and method to study subsurface damages". In: *Journée polissage optique*. Bordeaux, France, June 2015.

International conferences

Q. Pledel, D. André, and M.A. Celigueta. "A discrete element model compatible with continuum mechanic constitutive laws". In: *Materiaux2022*. Lille, France, Oct. 2022.

Q. Pledel, M. Huger, and D. André. "Thermomechanical modelling by the discrete element method of thermal shock on model refractory material". In: *15th International Ceramic Congress*. Perugia, Italy, June 2022.

F. Asadi et al. "Modeling the elastic properties of bi-phase refractories by using periodic homogenization approach with discrete element method (DEM)". In: *Unified International Technical Conference on Refractories (UNITECR 2022) 17th Biennial Worldwide Congress on Refractories*. Chicago, USA, Mar. 2022.

D. Andre et al. "Comparing Open-Source DEM Frameworks for Simulations of Common Bulk Processes". In: *VII International Conference on Particle-Based Methods*. Hamburg, Germany, Oct. 2021.

Farid Asadi et al. "DEM modelling of the quasi-brittle behavior of refractories by considering microcracks effect". In: *3rd International Postgraduates Seminar on Refractories*. Wuhan, China (virtual), Oct. 2020.

Farid Asadi et al. "Numerical modelling of the quasi-brittle behavior of materials byconsidering microcracks effect". In: *5th International ITASCA Symposium*. Vienna, Austria, Feb. 2020.

Farid Asadi et al. "Numerical modelling of wedge splitting test by discrete element approach: flat joint contact model". In: *Unified International Technical Conference on Refractories*. Yokohama, Japan, Oct. 2019.

Andrzej Warchal et al. "Reactivity of metallic additives and their influence on the key thermomechanical properties of steel flow control refractories". In: *Unified International Technical Conference on Refractories*. Yokohama, Japan, Oct. 2019.

Andrzej Warchal et al. "Study of the influence of additives (antioxidants) on the thermomechanical properties of carbon-bonded refractories". In: *62th International Colloquium on Refractories*. Aachen, Germany, Sept. 2019.

F Asadi et al. "Discrete element method modelling of wedge splitting test by focusing on the brittleness of quasi-brittle materials". In: *16th Conference of the European Ceramic Society*. Turin, Italy, June 2019.

Farid Asadi et al. "Micro-mechanics approach by Discrete Element Method". In: *61th International Colloquium on Refractories*. Aachen, Germany, Sept. 2018.

Marc Huger et al. "Thermomechanical behaviour of refractories, from model materials to industrial ones". In: *7th International Congress on Ceramics*. Foz do Iguaçu, Brasil, June 2018.

T Nguyen et al. "Numerical modelling by discrete element method of nonlinear mechanical behaviour of refractories: influence of damage involved by CTE mismatch". In: *14th International Ceramics Congress*. Perugia, Italy, June 2018.

Damien André, Truong Thi Nguyen, and Marc Huger. "A direct calibration method for cohesive beam bond models". In: *2nd YADE Workshop: Discrete-based modeling of multi-scale coupled problems*. Aix-en-Provence, France, Apr. 2018.

T Nguyen et al. "A discrete element approach for a better comprehension of influence of thermal damage on behavior of refractories". In: *60th International Colloquium on Refractories*. Aachen, Germany, Oct. 2017.

Andrzej Warchal et al. "Evolution during firing and resulting mechanical behavior of carbon-bonded refractories containing various antioxidants". In: *60th International Colloquium on Refractories*. Aachen, Germany, Oct. 2017.

T Nguyen et al. "Discrete element modelling: a promising way to account effects of damages generated by local thermal expansion mismatches on macroscopic behaviour of refractory materials". In: *Unified International Technical Conference on Refractories*. Santiago, Chili, Sept. 2017.

Andrzej Warchal et al. "Microstructure evolution during firing and resulting mechanical properties of steel flow control refractories containing various additives". In: *Unified International Technical Conference on Refractories*. Santiago, Chili, Sept. 2017.

Damien André et al. "A discrete element model of the brittle damages generated by thermal expansion of heterogeneous media". In: *Proceedings of 8th International Conference on Micromechanics of Granular Media: Powders & Grains 2017*. Montpellier, France, July 2017.

Andrzej Warchal et al. "Investigation of the influence of metallic additives on the thermomechanical properties of carbon-bonded refractory composite". In: *15th Conference of the European Ceramic Society*. Budapest, Hungary, June 2017.

Marc Huger et al. "Aluninum Titanate as a model material to optimize microstructure design of refractories for thermal shocks". In: *Workshop on "Modelling of refractory materials and ceramics, with a view to technological applications*. Trento, Italy, Apr. 2016.

Marc Huger, Damien André, and Thierry Chotard. "Micromechanical modelling of refractories: how to account of the effect of thermal history on mechanical behavior (not definitive yet)". In: *Workshop on "Modelling of refractory materials and ceramics, with a view to technological applications"*. Trento, Italy, Apr. 2016.

Yasmine Lalau et al. "In situ thermo-mechanical diagnostics of materials subjected to high solar flux: Test device development". In: *HTMC 15th International Conference on High Temperature Materials Chemistry*. Orleans, France, Apr. 2016.

Y. Lalau et al. "In situ thermo-mechanical diagnostics of materials subjected to high solar flux: Preliminary modelling work". In: *European congress and exhibition on advanced materials and processes*. Varsovie, Poland, Sept. 2015.

Damien André, Marc Huger, and Thierry Chotard. "A promising way to model refractory castables using the discrete element method". In: *CERMODEL 2015, Modelling and simulation meet innovation in Ceramics Technology*. Trento, Italy, July 2015.

M Jebahi et al. "A multi-scale coupling method to simulate the silica glass behavior under high pressures". In: *2nd ECCOMAS Young Investigators Conference (YIC 2013)*. Bordeaux, France, Sept. 2013.

Damien André, Jean-Luc Charles, and Ivan Iordanoff. "A new C++ workbench to develop discrete element simulations: GranOO". In: *2nd ECCOMAS Young Investigators Conference (YIC 2013)*. Bordeaux, France, Sept. 2013.

Ivan Iordanoff, Jean Luc Charles, and Damien Andre. "Development of the GranOO Discrete Element Platform for Dynamic Problems: Application for Tribological Application". In: *International Joint Tribology Conference*. Vol. 45080. American Society of Mechanical Engineers. Colorado, USA, Oct. 2012, pp. 325–329.

Damien André et al. "A quantitative discrete element model to investigate sub-surface damage due to surface polishing". In: *Engineering Systems Design and Analysis*. Vol. 44878. American Society of Mechanical Engineers. Nantes, France, July 2012, pp. 577–585.

National conferences

Q. Pledel, M. Huger, and D. André. "Modélisation de l'endommagement thermique de la microstructure de matériaux réfractaires modèles par la méthode des éléments discrets". In: *Materiaux2022*. Lille, France, Oct. 2022.

Quentin Pledel et al. "Stratégie de modélisation du comportement thermomécanique de matériaux hétérogènes par éléments discrets, optimisation par homogénéisation périodique". In: *Journées Annuelles du Groupe Français de la Céramique 2022*. Albi, France, Mar. 2022.

Vincent Longchamp et al. "Modélisation 3D par élément discret de céramiques projetées plasma à l'échelle de la porosité sous sollicitation dynamique". In: *15ème colloque national en calcul des structures*. Giens, France, May 2022.

D. André et al. "GranOO : une plateforme libre de calcul par la méthode discrète en mécanique des solides MED multi physique dédiée à la simulation de milieu continu". In: *15ème colloque national en calcul des structures*. Giens, France, May 2022.

Vincent Longchamp et al. "Modélisation de l'endommagement de céramiques projetées plasma sous sollicitations dynamiques à l'aide d'une approche multi-échelles discrète/continue". In: *Journée des Doctorants du CEA-CESTA*. Arcachon, France, May 2022.

Farid Asadi et al. "Numerical modelling of wedge splitting test: simulating the brittleness of quasi-brittle materials". In: *Journées 2020 Méthodes Numériques Fédération MATV2L*. Limoges, France, Feb. 2020.

Damien André, J Girardot, and C Hubert. "Une nouvelle approche combinée" élément discret/élément lattice" pour la simulation de milieu élastique fragile". In: *14ème colloque National en Calcul des Structure*. Giens, France, May 2019.

TT Nguyen et al. "Modélisation par éléments discrets des relations microstructure-propriétés de matériaux hétérogènes: impact du différentiel de dilatation thermique". In: *Colloque Matériaux*. Strasbourg, France, Nov. 2018.

T Nguyen et al. "Thermo-Mechanical Modelling of Refractories by Discrete Element Method (DEM) Simulation". In: *Journées Annuelles du Groupe Français Céramique*. Bordeaux, France, Mar. 2018.

Cedric Hubert et al. "Conduction électrique dans un domaine DEM continu". In: *13ème colloque National en Calcul des Structures*. Giens, France, May 2017.

Damien André et al. "Modélisation par élément discret à l'échelle de la microstructure de l'endommagement résultant des différences de dilatation thermique de matériaux hétérogènes fragiles. Incidence sur les propriétés macroscopiques". In: *13ème colloque National en Calcul des Structures*. Giens, France, May 2017.

Andrzej Warchal et al. "Study of the influence of additives (antioxidants) on the thermomechanical properties of carbon-bonded refractories". In: *Journées Annuelles du Groupe Français Céramique*. Valenciennes, France, Mar. 2016.

Y. Lalau et al. "Diagnostic thermomécanique sous flux solaire concentré : quel dispositif". In: *Ecole "Energies et Recherches 2016*. Roscoff, France, Mar. 2016.

Damien André et al. "Modélisation par éléments discrets de matériaux élastiques fragiles. Application à l'essai d'indentation sur verre de silice". In: *11ème colloque National en Calcul des Structures*. Giens, France, May 2013.

Jean-Luc Charles, Damien André, and Ivan Iordanoff. "GranOO: plateforme de simulation DEM en dynamique explicite". In: *11ème colloque National en Calcul des Structures*. Giens, France, May 2013.

Mohamed Jebahi et al. "Simulation du comportement de la silice sous indentation Vickers par la méthode des elements discrets: densification et mécanismes de fissuration". In: *21ème Congrès Français de Mécanique*. Bordeaux, France, Aug. 2013.

Ivan Iordanoff et al. "Méthode des éléments discrets: des problèmes multi-corps aux problèmes d'endommagement dynamique complexes." In: *10ème colloque National en Calcul des Structures*. Giens, France, May 2011.

Damien André, Ivan Iordanoff, and Jean-Luc Charles. "Modèle par éléments discrets pour l'étude du comportement dynamique d'un matériau élastique. Méthodologie de quantification des paramètres microscopiques." In: *10ème colloque National en Calcul des Structures*. Giens, France, May 2011.

Awards and investments in scientific community

2022 Vincent Longchamps won the second price of the "*Society of Advanced Manufacturing Process Engineering*" for its PhD award

2022 Visiting researcher during 3 months in the Cimne laboratory (Barcelona, Spain, Jecs Trust founding) *study of a coupling strategy between FEM and DEM*

2021 Co-organizer of the mini-symposia "*Discrete method in computational mechanics*" of the *14th world congress on computational mechanics*

2019 Andrzej Warchal won the first price of the Gustav Eirich award of the European Centre for Refractories for its PhD

2018 Member of the editorial board of the french *Matériaux 2018 national conference*, for supervising simulation sessions, Strasbourg, France

2018 Organizing the french *Computational discrete element method with GranOO* workshop which bring together the GranOO's user, Limoges, France

2015 Member of the editorial board of the *4th International Conference on parallel, distributed, grid and cloud computing for engineering*, Dubrovnik, Croatia

2012 Award of the ScienceDirect top 25 list of most downloaded articles (ranked 24th) for the *Computer Methods in Applied Mechanics and Engineering (CMAME)* journal from january to december period