

# MuORoD

Multi-Objective Robust Design

## MAIN PARTICIPANTS

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## OVERVIEW (keep within this page)

**Starting year:** 2012      **Current researchers** (permanent/non-permanent): (3/1) person-month/year

<b>Positioning</b> <i>(Multiple selection allowed – total 100%)</i>	<b>Transportation</b>	<b>Energy</b>	<b>Eng. for Health</b>	Include partner from <input type="checkbox"/> Outside ElyT <input type="checkbox"/> Industry
				Main funding source(s) <input checked="" type="checkbox"/> Public project(s) <input type="checkbox"/> Industrial <input type="checkbox"/> Own resources
				IFS CRP/LyC project? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
				For main projects: Agency / year / name of project ( <i>up to 3, past projects in gray</i> ) <ul style="list-style-type: none"> <li>• MNRT fund for a Ph.D., 2016-2020</li> <li>• Mega Ph.D.School funds for 3 months grant, 2020</li> </ul>
<b>Other:</b>				Estimated annual budget: From institutions 35keuros

<b>Highlights &amp; Outstanding achievements</b> <small>(3-5 bullet points)</small> <ul style="list-style-type: none"> <li>• We have proposed an innovating optimization scheme based on the IGA formulation</li> <li>• Optimization criteria is original and contact handling in such situation has been treated</li> <li>• One journal paper has been accepted recently, one under review and one submitted soon</li> <li>• Ph.D. Student Pradeep has been awarded the Mega Ph.D. School grant for short research stay in Pr. Shimoyama's Lab</li> </ul>	<b>Illustration</b> <small>(5x5 cm<sup>2</sup> max)</small>
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## PROJECT DESCRIPTION

### Background (10 lines max; Calibri 11)

In this project we focus on the robust shape optimization aiming at decreasing the squeal noise of a classical brake system. In the first steps a FEM of the pad and the disk have been modeled. Then stability diagrams have been generated to understand how geometrical parameters influence stability behavior of the structure. Next step will be to describe the pad as an iso-geometric element (IGA) in contact with the disk. Such formulation will enable fast and accurate shape optimization loop based on EGO approach, i.e. meta-heuristics optimizer on a meta-model surface response of the physical model.

### Key scientific question (2 lines max; Calibri 11)

Numerical optimization scheme for non-gradient criteria.  
Uncertainties quantification handle by the optimization loop.

### Research method (8 lines max; Calibri 11)

Shape optimization with iso-geometric models is a hot topic nowadays, as it will enable significant improvement in computing time cost and result accuracy. One the other hand nearly no results have been obtained on robust shape optimization of brake systems as such systems are very complex to simulate when considering non-linear behavior such as squeal noise. Black box optimization approaches have been successfully developed recently to address complex problems, such as robust optimization, where at least the first and second moment order of the cost function are to be considered. We aim at enabling practical systems such as brakes to benefit from such approach. particles.

### Research students involved (gray color for previous years)

#### Post-doc (years, institution):

- Renata Troian (2013-2014, ANR JCJC S.Besset)

#### Ph.D. candidates (years, institution):

- Pradeep Mohanasundaram (2016-present, MNRT)

#### Master/Bachelor students (years):

- Kazuki Ozawa (2018-2019, IFS Tohoku University)

### Visits and stays (gray color for previous years)

#### FR to JP (date, duration):

- P. Mohannasundaram (Jan. 2021 – March. 2021, 3 months)
- S. Besset (July 2019, 1 week)
- P. Mohannasundaram (Sept. 2018 – Aug. 2019, 1 year)
- F. Gillot (Sept. 2019-Aug. 2020, 1 year)
- F. Gillot (May 2015, 1 month)

#### JP to FR (date, duration):

- K. Ozawa (Dec. 2018 – Feb. 2019, 3 months)
- K. Shimoyama (Feb. 2016, 1 month)
- K. Shimoyama (Oct – Dec 2013, 3 months)

## COMMUNICATIONS AND VALORIZATION

### Journal publications *(gray color for previous years)*

Authors	Title	Journal	Vol.	pp. / ID	Year	DOI
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Mohanasundaram, Pradeep, Frédéric Gillot, Koji Shimoyama, and Sébastien Besset. "Shape optimization of a disc-pad system under squeal noise criteria." SN Applied Sciences 2, no. 4 (2020): 1-15.

Troian, Renata, Koji Shimoyama, Frédéric Gillot, and Sébastien Besset. "Methodology for the design of the geometry of a cavity and its absorption coefficients as random design variables under vibroacoustic criteria." Journal of Computational Acoustics 24, no. 02 (2016): 1650006.

### Conferences *(gray color for previous years)*

Authors	Title	Conference	Date	City	Country	DOI <i>(if applicable)</i>
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Mohanasundaram, Pradeep, Frédéric Gillot, Koji Shimoyama, and Sébastien Besset, Iga based shape optimization under mechanical stability criteria, 14<sup>th</sup> WCCM 2020, Paris, France

Mohanasundaram, Pradeep, Frédéric Gillot, Koji Shimoyama, and Sébastien Besset, Effect of IGA formulation on the simulation of friction instabilities of disc-pad systems, 7<sup>th</sup> International congress on Isogeometric Analysis - IGA 2019, 18<sup>th</sup>-20<sup>th</sup> September 2019, Munich, Germany

Mohanasundaram, Pradeep, Frédéric Gillot, Koji Shimoyama, and Sébastien Besset, Sensitivity of shape parameters of brake systems under squeal noise criteria, 6<sup>th</sup> International congress on Engineering Optimization – EngOpt 2018, 17<sup>th</sup>-19<sup>th</sup> September 2018, Lisbon, Portugal

Frederic Gillot, Renata Troian, Koji Shimoyama, Sebastien Besset, Robust shape optimization under vibroacoustic criteria and uncertain parameters, 11th World Congress on Structural and Multidisciplinary Optimization, 7th - 12th, June 2015, Sydney Australia