3-6 MONTHS INTERNSHIP
2009-2010

Department of Mathematics, Computer science and control theory

Superviser :

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INTERNSHIP DESCRIPTION

Domain : Shape control, Finite Element Modelling, Optimisation, piezoelectricity, structure, composite

Title :

SHAPE CONTROL WITH PIEZOELECTRIC ACTUATORS

Mirrors for space optics must meet stringent constraints on the mass, stiffness and stability. The mass constraints are fulfilled by choosing lightweight materials and by removing material in structures. Rigidity must be provided to limit deformation at the surface of the mirror during manufacturing operations and also to minimize distortion when the mirror is no longer subject to gravity in orbit. Finally, stability is achieved by using materials with very low coefficient of thermal expansion or a high thermal conductivity to limit the thermo-elastic deformations in orbit.

However, despite all the precautions taken when selecting materials and during production, there may be thermo-elastic and gravitational deformations that disrupt the smooth functioning of the mirror. We want to study the control of these deformations by piezoelectric elements controlled to ensure the shape of the mirror surface. The study will be conducted initially on a demonstrator partially made in composite.

The internship consists in:

- the quantification of deformations due to gravity and temperature gradients from a finite element modelling of the demonstrator
- the optimization of positioning and number of piezoelectric elements to counter these distortions
- the development of the strategy for controlling piezoelectric actuators
- the validation of results from tests on the demonstrator

The duration of the internship is approximately 3 to 6 months (the objectives of the internship will be adapted to the duration).

Methods: system dynamics, composite, Finite Element Methods, system control.

Theoretical Research	80 %	Experimental Research	20%

APPLICANT PROFILE

Knowledge and required level:

Finite Element software and Matlab

Acknowledge in Composite

Applications should be sent by e-mail to the supervisor.