Multi-scale simulation of process-induced stress of FRP and optimization of molding process

Project Leader
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1. Objective

This project is aimed at:

It is well known that a micro-scale residual stress field on FRP has a strong influence on matrix-crack initiation. Therefore, the strength of FRP can be improved by minimizing the residual stress using an appropriate molding condition. In the first stage of this project, we aim to develop a multi-scale process simulation method. Such a method may allow us to predict the local distribution of stress in the vicinity of mesoscopic boundaries such as inter-lamina boundaries, at the surface, and so on. The second stage of the project will aim to develop an optimization system to minimize the residual stress obtained in a multi-scale simulation.

2. Project Outline

To that end, the project will consist of the following phases:

(a) Multi-scale FEM simulation of FRP
(b) Molding-process simulation of FRP
(c) Optimization of the FRP molding process

3. Expected Performance

In this project, the successful candidate would be expected to:

(a) Produce a multi-scale model of process-induced stress of FRP
(b) Develop software to optimize the FRP molding process
(c) Develop a system to optimize the FRP molding process

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

(a) Fundamental knowledge of FEM (finite element method)
(b) Fundamental knowledge of composites
(c) Fundamental knowledge of optimization

References

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2) Tatsuro Kosaka and Kazuhiro Kusukawa , Experimental and analytical study of process-induced stress in reinforcement fibers of FRP, Proc. 12th Inter. Conf. Durability Compos. Sys. (DURACOSYS 12), Texas, USA, (2016)
3) Tatsuro Kosaka, Go Ueyama, Kazuhiro Kusukawa, In-Situ Monitoring and Simulation of Cure-Process of CFRP Using Optical Fiber Sensors, Proc. ECCM-17, Munich, Germany, (2016)

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