Emergent Research:
The PIMS Postdoctoral Fellow Seminar

Dec 8, 2021 | 9:30am Pacific

25 Pacific Institute *for the* Mathematical Sciences

An Algebraic Approach on Fusions of Synchronization Models

ABSTRACT:
In this talk, we study an algebraic approach to fusions of synchronization models. The Lohe tensor model is a generalized synchronization model which contains three synchronization models; the Kuramoto model(on the circle), the swarm sphere model(on the sphere), and the Lohe matrix model(on the unitary group). Since the Lohe tensor model contains any synchronization models defined on any rank and size of tensors, we use this model to study fusions of synchronization models. The final goal of the study is to present a fusion of multiple Lohe tensor models for different rank tensors and sizes. For this, we identify an admissible Cauchy problem to the Lohe tensor model with a characteristic symbol consisting of a size vector, a natural frequency tensor, a coupling strength tensor, and an initial admissible configuration. In this way, the collection of all admissible Cauchy problems for the Lohe tensor models is equivalent to the space of characteristic symbols. On the other hand, we introduce a binary operation which we call "fusion operation," as a binary operation between characteristic symbols. It turns out that the fusion operation satisfies associativity and admits an identity element in the space of characteristic symbols that naturally form a monoid. By the fusion operation, the weakly coupled system of multi tensor models can be obtained by applying the fusion operation of multiple characteristic symbols corresponding to the Lohe tensor models. As a concrete example, we consider a weak coupling of the swarm sphere model and the Lohe matrix model and provide a sufficient framework leading to emergent dynamics to this coupled model.

Hansol Park
PIMS PDF, SFU

SPEAKER BIO:
Hansol Park was born and raised in the Republic of Korea(South Korea). He got a Ph. D. in mathematics in 2021 from Seoul National University(Advisor: Prof. Seung-Yeal Ha). During his doctoral period, he tried to integrate various types of synchronization models. Currently, he is a PIMS Postdoc at Simon Fraser University under Prof. Razvan C. Fetecau. So far, most of his researches are related to particle systems with interactions. Recently, he is interested in variation methods (minimization problem) and information geometry.

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