Applied Category Theory: Towards a science of Interdisciplinarity

Abstract

Effective interoperation between multiple scientific disciplines is crucial to systems engineering. Can the study of interoperabilitythe working negotiations and hand-offs between theories and modelsitself be made into a hard science? Hard sciences are based on mathematics, so this would require a mathematics of interoperability, a mathematics whose subject consists of the bridges and analogies that make data- and model-integration actually work. I propose that category theory serves this purpose exceptionally well.

In this talk, I will give evidence for the above claim, given only the background that the ACT4E audience has seen so far. I will focus on operads, which offer a framework for various forms of compositionality. In particular, I will discuss how operads model the interconnection of dynamical systems, provide a new method for solving systems of nonlinear equations, and explain how these two issues are connected category-theoretically. Finally, I'll explain how all this fits into a larger mathematical approach to interdisciplinarity.