CMS 270. Special Topics in CMS

Data-driven modeling of dynamical systems. 9 units (3-0-6); first term. Prerequisites: Basic differential equations, linear algebra, probability and statistics: ACM 104, ACM/EE 106 ab, ACM/EE/IDS 116 or equivalent. The explosion of data in the sciences and engineering poses new challenges for learning interpretable models using efficient algorithms. When governing equations are unavailable, the tools of dimensionality reduction and machine learning can be leveraged for data-driven pattern extraction, inference and prediction. This course covers the theory and algorithms behind data-driven modeling of dynamical systems, using concepts from operator theory, statistical computing and network science. Applications will be drawn from the physical, engineering and biological sciences. (Topics include but are not limited to: Modal decompositions, Koopman operator approximation, Laplacian embeddings (diffusion maps, etc), physics-constrained neural networks, and autoencoders.) **Instructor: Manohar**