This course provides an introduction to Reduced Order Modeling of large-scale dynamical systems (dimension reduction). We shall begin with basic systems theory, then develop several state-of-the-art numerical methods for reducing the dimension of such systems. In the process, we shall describe the fundamental numerical linear algebra technology (dense methods and Krylov subspace techniques) that underpin the leading reduction algorithms.

Roughly three fourths of the course will address linear dynamical systems; the remainder will introduce methods for nonlinear systems. The focus shall be on computational methods that have robust implementations and substantial theoretical justification. The success of these algorithms will be demonstrated on realistic large-scale systems.

The course will be accessible to all students with a good background in linear algebra (e.g., CAAM 440 or 453/553). In particular, mathematically-inclined scientists and engineers are encouraged to participate.