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Numerical Solution of Non-Normal Coefficient Sylvester Equations for Partial Differential Equations

A method for solving certain partial differential equations, such as the heat or wave equation, numerically consists of discretizing the equation to obtain a matrix equation known as a *Sylvester equation*. It is well-known that Sylvester equations equations can be solved quickly if among other conditions, certain matrices are normal. In this talk, we will discuss to solve Sylvester equations while trading in the normality condition for a norm condition. The main tool used here is *dilation theory*, where we can view an operator as the top left entry of a bigger operator with nice properties, such as being normal. Additionally, we will look at an example of solving a partial integro-differential equation numerically which results in a Sylvester equation with a non normal coefficient.

This is joint work with Dr. Mikael Slevinsky and Dr. Raphael Clouatre.