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### *Computing with infinite linear groups: from finite to strong approximation*

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These three lectures survey work on a long-running project aimed at practical computation with linear groups over infinite domains.

In the first lecture we introduce the classical method of finite approximation. We describe how this method has been applied to obtain algorithms that solve fundamental problems such as deciding finiteness of matrix groups (over any field) and testing virtual solvability (thereby deciding the Tits alternative).

In the second and third lectures the focus is on a computational realization of strong approximation for linear groups. This enables us to define the congruence closure of a finitely generated dense group and its level. We then discuss how to compute the level of a dense subgroup of  $SL(n, \mathbb{Q})$  or  $Sp(n, \mathbb{Q})$ . Time permitting, some applications in small degrees  $n$  will be mentioned.

The work surveyed is joint with Alla Detinko and Alexander Hulpke (lectures 2, 3), and Alla Detinko and Eamonn O'Brien (lecture 1).