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Session on *"Hybrid Symbolic-Numeric Computation"*

Hybrid Symbolic-Numeric Computing in Linear and Polynomial Algebra

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We introduce hybrid symbolic-numeric methods which solve the *approximate* `GCD` problem for polynomials presented in Bernstein and Lagrange bases.

We adapt Victor Y. Pan's root-based algorithm for finding approximate `GCD` to the case where the polynomials are expressed in Bernstein bases. We use the numerically stable companion pencil of Guðbjörn Jónsson to compute the roots, and the Hopcroft-Karp bipartite matching method to find the degree of the approximate `GCD`. We offer some refinements to improve the process.

We also introduce an algorithm with similar idea, which finds an approximate `GCD` for a pair of approximate polynomials given in a Lagrange basis. More precisely, we suppose that these polynomials are given by their approximate values at distinct known points. We first find each of their roots by using a Lagrange basis companion pencil for each polynomial. We introduce new clustering algorithms and use them to cluster the roots of each polynomial to identify multiple roots, and then *marry* the two polynomials using a *Maximum Weight Matching* algorithm, to find their `GCD`.

Keywords
Bernstein basis, Approximate `GCD` , Maximum matching, Root clustering, Lagrange basis, Maximum weight matching