Curves and their Jacobians in computer algebra

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Algebraic curves over number fields play an important role in arithmetic geometry, for example in the proof by Andrew Wiles of the modularity Theorem, which uses elliptic curves. A very useful object for the study of more general algebraic curves is its Jacobian, which has a more linear structure than the curve itself.

This talk describes how one can calculate with Jacobians in computer algebra systems. Many of these techniques use analytic approximations, in which case it is important to certify the correctness of such results. We discuss current algorithms by many authors [1, 2, 3] for:

1. Calculating endomorphism rings of Jacobians;
2. Decomposing Jacobians into simple factors; and
3. Reconstructing curves from period matrices.

References

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[2] R. Lercier, C. Ritzenthaler and J. Sijsling, Reconstructing plane quartics from their invariants, accepted by *Disc. Comp. Geo.*

[3] P. Molin and C. Neurohr, Computing period matrices and the Abel-Jacobi map of superelliptic curves, *Math. Comp.* **88** (2019), no. 316, pp. 847–888.