

# Certified computation of periods of algebraic Riemann surfaces

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## Presentation Description:

Our research adapts previous methods and presents algorithms approximating period matrices of Riemann surfaces with proven error bounds. The algorithms aim to save running time while keeping the accuracy. The algorithms are intended to be incorporated this code into SageMath so that certified computation of period matrices will be readily available for researchers who need them.

## Abstract:

Integration of functions are approximations of the area that the functions cover. Matrices are similar to some boxes being stacked together by rows and columns, but the objects they contain are the numbers. Our protagonists are Riemann surfaces, which have the shape of donuts with one hole or even more holes. Our job is to compute period matrices, which are one category of matrices, of Riemann surfaces, by integrating some special functions on the surface. We provide the proven error bound of period matrices, since each number of period matrices are transcendental, which means that they cannot be compared easily just like  $\pi$ . We adapt several methods, including Taylor's theorem with the Cauchy form of the error bound and other theorems to derive an error bound. We adapt the existing work to SageMath and obtain two algorithms. We expect the new methods to significantly reduce the running time and be convenient for researchers in need.