

Computation and visualization of cuspidal waveforms for modular group using GridMathematica

ABSTRACT

Spectral studies on the eigenfunctions of Laplace-Beltrami operator on a cusp manifold are known to contain both discrete and continuous eigenvalues. The discrete eigenfunctions are usually called Maass cusp forms where their eigenvalues are not known analytically. The aims of this report were to compute the eigenvalues $\lambda = r^2 + 1/4$ for the modular group, $PSL(2, \mathbb{Z})$ numerically and visualize the waveforms using GridMathematica. At the same time, we compared the performance of parallel programming (GridMathematica) and normal programming (Mathematica). This serves to show the feasibility and advantages of using the parallel version of commercially available software for complex computations of Maass cusp forms. In our computer search for 33 eigenvalues in the r -interval $[9, 30.4]$, we found that the performance of the parallel programme is about six times faster than the normal programme.

Keyword: GridMathematica; Maass cusp forms; Modular group