1046-14-991   **G Sujeeva Wijesiri*** (`gswijesi@oakland.edu`), Department of Mathematics & Statistics, Oakland University, Rochester, MI 48309. *Theta functions for small genus curves with automorphisms.*

Let $\mathcal{X}$ be an irreducible, smooth, projective curve of genus $g \geq 2$ defined over the complex field $\mathbb{C}$. Then there is a covering $\pi : \mathcal{X} \longrightarrow \mathbb{P}^1$, where $\mathbb{P}^1$ denotes the projective line. The problem of expressing branch points of the covering π in terms of the transcendentals (period matrix, thetanulls, e.g.) is classical. It goes back to Riemann, Jacobi, Picard and Rosenhein. Many mathematicians, including Picard and Thomae, have offered partial treatments for this problem. In this work, we address the problem for cyclic curves of genus 2, 3, and 4 and find relations among theta functions for curves with automorphisms. To characterize the locus of cyclic curves by analytic conditions on its Abelian coordinates, we use some classical formulas and symbolic computations, especially for genera 2 and 3. Fast genus 2 curve arithmetic in the Jacobian of the curve used in cryptography is based on inverting the moduli map for genus 2 curves and on some other relations on theta functions. We determine similar formulas and relations for genus 3 hyperelliptic curves. It is still to be determined whether our formulas for genus 3 curves can be used in cryptographic applications as in genus 2 curves. (Received September 13, 2008)