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Deforming Cylindrical Surfaces in Hyperbolic 3-manifolds by their Harmonic Mean Curvature. Preliminary report.

We consider the harmonic mean curvature flow (HMCF) of axially symmetric surface around a closed geodesic in Hyperbolic 3-manifold. Assuming the initial surface is strictly convex and HMC $< 1/2$, we obtain the optimal asymptotic estimates of both principal curvatures: $\lambda_1 \approx e^{-t}, \lambda_2 \approx e^t$. The asymptotic shape of the surface as it converges to the closed geodesic is studied by rescaling the metric and showing that two principal curvatures $\tilde{\lambda}_1, \tilde{\lambda}_2$ and height function $\tilde{r}$ of the rescaled surface converge uniformly to 0, r_0^{-1}, and r_0, respectively, for some constant r_0. Analyzing the principal curvatures of evolving cylindrical surface presents a novel problem since we expect the small principal curvature to become zero and the large principal curvature to become infinity. The curvature estimates obtained in Theorem 4.1 of [Andrews94] and Theorem 5.1 of [Huisken84] for spherical hypersurfaces are no longer valid since they prove that the ratio of principal curvatures are uniformly bounded. We will have to estimate each principal curvature separately and also estimate their product, i.e. the Gauss curvature, which remains more or less constant throughout the evolution process. (Received July 16, 2012)