# Compressibility and rarefaction effects on entropy and entropy generation in micro/nano Couette flow using DSMC

**Omid Ejtehadi, Javad Abolfazli Esfahani, Ehsan Roohi**[1]
Department of Mechanical Engineering, Faculty of Engineering, Ferdowsi university of Mashhad, Mashhad, Iran, P.O. Box: 91775-1111

**Abstract.**
In the present work, compressible flow of argon gas in the famous problem of Couette flow in micro/nano-scale is considered and numerically analyzed using the direct simulation Monte Carlo (DSMC) method. The effects of compressibility and rarefaction on entropy and entropy generation in terms of viscous dissipation and thermal diffusion are studied in a wide range of Mach and Knudsen numbers and the observed physics are discussed. In this regard, we computed entropy by using its kinetic theory formulation in a microscopic way while the entropy generation distribution is achieved by applying a semi-microscopic approach and thoroughly free from equilibrium assumptions. The results of our simulations demonstrated that the entropy profiles are in accordance with the temperature profiles. It is also illustrated that the increase of Mach number will result in non-uniform entropy profiles with increase in the vicinity of the central regions of the channel. Moreover, generation of entropy in all regions of the domain stages clear growth. By contrast, increasing the Knudsen number has inverse effects such as: uniform entropy profiles and a falling off in entropy generation amount throughout the channel.