Analysis of fluid lubrication mechanisms in metal forming at mesoscopic scale

The lubricant entrapment and escape phenomena in metal forming are studied experimentally as well as numerically. Experiments are carried out in strip reduction of aluminium sheet applying a transparent die to study the fluid flow between mesoscopic cavities. The numerical analysis involves two computation steps. The first one is a fully coupled fluid-structure Finite Element computation, where pockets in the surface are plastically deformed leading to the pressurization of the entrapped fluid. The second step computes the fluid exchange between cavities through the plateaus of asperity contacts with the plane tool, one cavity at a time.