Modeling Expanding Polyurethane Foam Flow in Vented Mold Cavities

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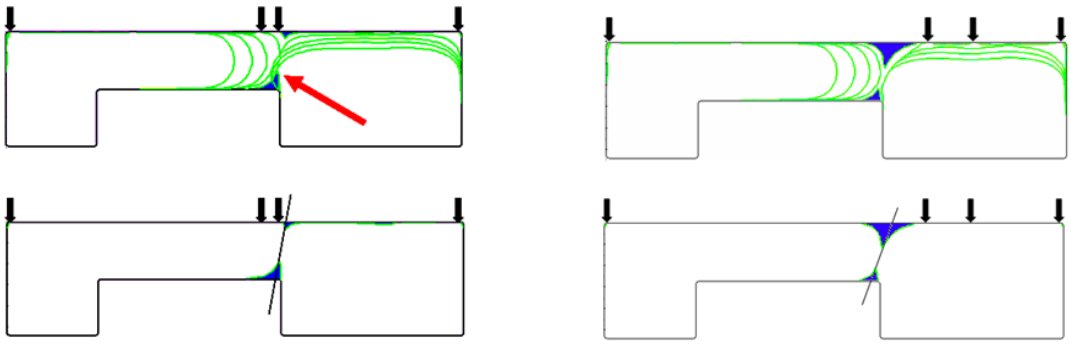
Flexible polyurethane foam is used widely for cushioning seats in cars, planes and furniture. The reacting mixture is poured at one or more locations at the bottom of the mold; this expands and rises to fill the mold, leaving air pockets or unfilled regions in some cases. Both 2-dimensional and 3-dimensional flow simulations are being run using FLUENT software —the latter set in the High Performance Computing Center (HPCC) at MSU. This is a collaborative project between JCI and MSU aimed at developing accurate predictions of (a) the flow after multiple flow fronts of expanding foam meet around an insert, say and in the presence of different venting patterns – see figures below; and of (b) the effect of serial pours of reacting mixture after a



finite time interval on the distribution of temperature in the mold and the meeting of the expansion flow fronts. The figure on the left presents computed flow patterns near the merging foam expansion fronts with one of the best venting patterns resulting in minimal air entrapment; while the figure on the right presents corresponding results for a vent configuration that leads to significant air entrapment (blue region in figure).