Two degree of freedom frequency domain surface location error prediction

This paper presents a two degree of freedom (DOF) closed-form frequency domain solution for surface location error prediction, including both the tool and workpiece flexibility. The cycloidal tool path is incorporated in the solution and the machined surface geometry is described by combining the tool path with the tool and workpiece displacements in two directions. For prediction validation, a two DOF flexure stage with tunable dynamics was constructed and milling tests were performed over a range of spindle speeds. Time domain simulations were also completed and a comparison between the closed-form frequency domain surface location error predictions, time domain predictions, and experimental results is provided.