Optimization of Cutting Parameters for Hard Machining of Superalloy Through Process Modelling

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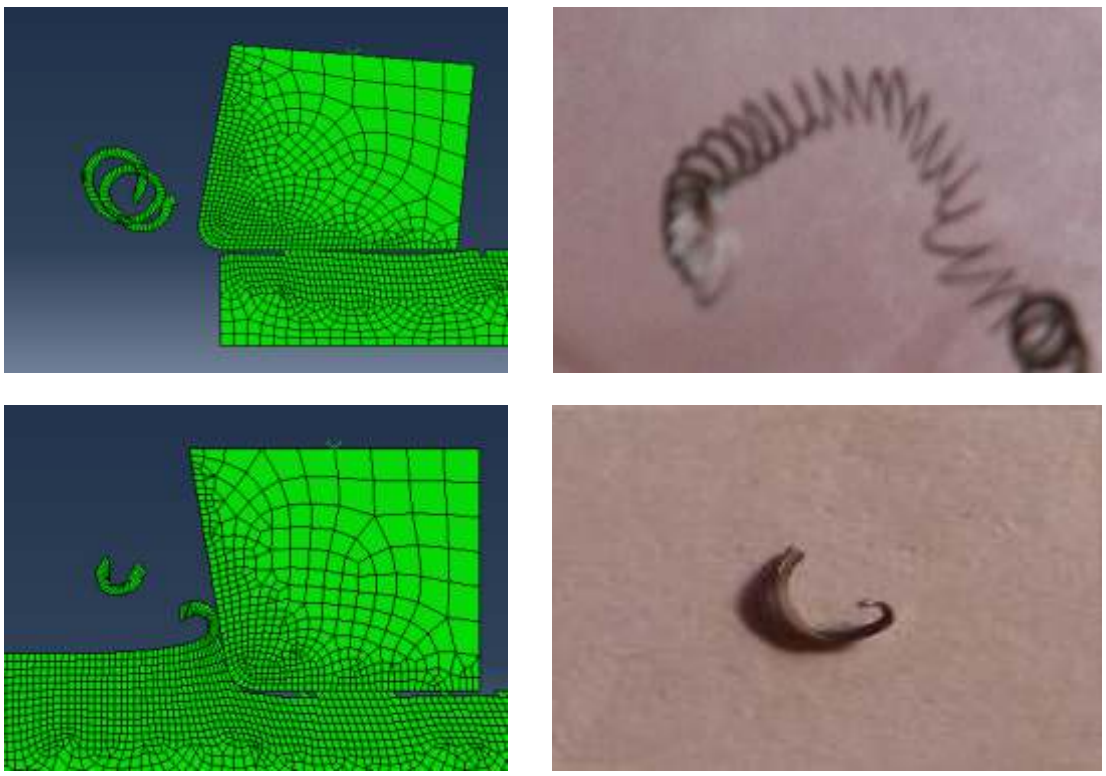
Abstract:

To study numerical simulation for hard turning of nickel based superalloy - Inconel 718 and to optimize the cutting parameter. The numerical model was done in Abaqus/CAE V6.10 to examine the cutting force, temperature, stress and strain rate and the model is validated with the experimental results.

The Abaqus explicit dynamic analysis process with Arbitrary Lagrangian Eulerian adaptive meshing Finite Element Method is used with to simulate the model. The thermo-physical properties of the work and tool materials and the flow stress data of inconel718 alloy taken from the Johnson-Cook material models incorporated into the FE model. The work piece was modeled as deformable body and the tool as rigid materials. Finite element modelling for different rake angle and different depth of cut with different cutting speed is performed for hard turning of nickel based superalloy – Inconel 718.

FEA simulation was carried out using Abaqus for machining of Inconel 718 round bar, so that the cutting parameters can be optimized to reduce the development time and cost of the process. Force and temperature increases as the rake angle reduces which we observed in the simulation results chip obtained in the simulation matches with experiments. Temperature measurement of numerical and experimental trails also matches and the percentage error is found to be not more than 9 percent.



Chip morphology