

Algorithm Closed-loop simulation

- 1 Import classes
- 2 Open the FEM file
- 3 Initialize parameters of FEM and Controller
 $t_0 = 0, t_f = t_0 + t_s, T(t_0) = T_0, q = q_0$
- 4 While $t_f \leq t_{end}$:
 - 1 Call FEM software to compute the FEM
 - 2 Get the temperature distribution $T(t_f)$
 - 3 Calculate melt pool width $w(t_f)$ from $T(t_f)$
 - 4 Apply controller to update laser power $q(t_f)$
 - 5 Update iterative variables in the FEM
 $t_0 \leftarrow t_f, T(t_0) \leftarrow T(t_f), q \leftarrow q(t_f)$
- The computation time of FEM is t_s , where t_s is the sampling time in discrete-time feedback control.