

The growing field of additive manufacturing is a rich source of mathematical problems. We consider the effect of temperature on two aspects of the 3-D printing process. Initially, rigid polymer feedstock is extruded through a “hot end” to form the printed object, but only if it gets hot enough to soften. Otherwise, the nozzle will clog. We present both a simplified model for the temperature field, and threshold criteria allowing prediction of clogging behavior. The extrudate then welds to the previously printed material; the temperature is directly related to the weld strength. We present a model for the temperature field in the welded layers, applicable to general geometries, which allows direct prediction of weld strength.