Hotspot Cooling with Self-Propelled Jumping Condensate XI-
AOPENG QU, JONATHAN B. BOREYKO, FANGJIE LIU, CHUAN-HUA
CHEN\(^1\), Department of Mechanical Engineering and Materials Science, Duke Uni-
versity, Durham, NC 27708 — Dynamic hotspots are prevalent in electronic systems
including microprocessors and power electronics with constantly changing comput-
ing tasks or payloads. Here, we report a new adaptive hotspot cooling technique
that rapidly responds to moving hotspots in a passive manner independent of ex-
ternal forces. The hotspot cooling is based upon the self-propelled jumping of drop-
wise condensate, which directly returns the working fluid from a superhydrophobic
condenser to an opposing superhydrophilic evaporator. The adaptive thermal man-
gement is accomplished by the preferential evaporation of water at the hotspots
and the rapid jumping return of the condensate across the very short inter-plate dis-
tance. The proof-of-concept for this hotspot cooling technique will be demonstrated
by the adaptive response to hotspots at increasing heat fluxes.

\(^1\)Corresponding author

Xiaopeng Qu
Department of Mechanical Engineering and Materials Science,
Duke University, Durham, NC 27708

Date submitted: 08 Aug 2012