Non-simultaneous quenching in a system of heat equations coupled at the boundary

by

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We study the formation of singularities in finite time for solutions (u, v) of the parabolic system

$$\begin{cases} u_t = u_{xx}, \\ v_t = v_{xx}, \end{cases} \quad \text{in } (0,1) \times (0,T),$$

coupled at the boundary through a nonlinear flux at one border and zero flux at the other border

$$\begin{cases} u_x(0,t) = v^{-p}(0,t), & u_x(1,t) = 0, \\ v_x(0,t) = u^{-q}(0,t), & v_x(1,t) = 0, \end{cases} \quad \text{in } (0,T),$$

We characterize in terms of the parameters involved when non-simultaneous quenching may appear. Moreover, if quenching is non-simultaneous we find the quenching rate and the quenching set. We also find a possible continuation after quenching of the solutions.

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