In this article, a fuzzy boundary geometric controller that stabilizes a class of nonlinear distributed parameter systems (DPSs) is proposed. The design procedure relies on the use of Takagi-Sugeno (T-S) type fuzzy partial differential equation (PDE) model, which approximates the dynamical behavior of the nonlinear DPS. The T-S fuzzy PDE model is constructed through “fuzzy blending” of local linear PDE models of infinite characteristic indexes. This is a challenging task in the design procedure of fuzzy PDE model-based boundary controller in the framework of the well-established geometric control theory. To overcome this constraint, it is proposed in this article to resort to the concept of extended operator in order to transform the T-S fuzzy PDE model with boundary control to an equivalent fuzzy PDE model with punctual control and finite characteristic index. Based on the developed fuzzy model, a fuzzy boundary geometric controller is derived and sufficient conditions of exponential stability of the resulting closed-loop system are established by employing the Lyapunov direct method. The stabilizing performance of the proposed fuzzy PDE model-based boundary geometric controller is evaluated on benchmark control problems and compared with other existing control methods via numerical simulations.