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**Development for a Theoretical Model of Crossflow-induced Boundary-layer Transition**[1] MAKOTO HIROTA, Institute of Fluid Science, Tohoku University, YUKI IDE, Japan Aerospace Exploration Agency, TAKAHISA HAYASHIDA, Graduate School of Information Sciences, Tohoku University, YUJI HATTORI, Institute of Fluid Science, Tohoku University — On widely-used swept wings of aircrafts, laminar-turbulent transition of three-dimensional boundary layer mainly occurs through the process in which (i) a crossflow instability (referred to as the primary) first grows spatially and generates a vortex street and, then, (ii) the vortex street further induces low-speed streaks in the mainstream distribution that becomes unstable to a high-frequency secondary instability. Direct numerical simulation (DNS) can reproduce this process accurately, but the transition location sensitively depends on how the two kind of disturbance sources are fed to the primary and secondary instabilities, respectively. It is moreover difficult to understand the dependency on various flow parameters. In this study, we develop a theoretical model to estimate the growth rates of both the primary and secondary instabilities according to linear stability analyses. By noting a scale similarity to the Kelvin-Helmholtz instability, the inflection point and the shear profile of the flow enable us to estimate the growth rates. Our method is expected to be not only efficient to predict the transition location, but also useful for finding less unstable flow profiles that control devices should attain.

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