Sub- and super-synchronous self-excited vibrations of a Columnar Rotor due to axial clearance flow

H. Nishimura\textsuperscript{a}, H. Horiguchi\textsuperscript{b}, T. Suzuki\textsuperscript{c}, K. Sugiyama\textsuperscript{b} and Y. Tsujimoto\textsuperscript{b}

\textsuperscript{a}School of Engineering Science, Osaka University, 1-3 Machikaneyama, Toyonaka, 560-8531 Osaka, Japan
\textsuperscript{b}Graduate School of Engineering Science, Osaka University, 1-3 Machikaneyama, Toyonaka, 560-8531 Osaka, Japan
\textsuperscript{c}Toshiba Corporation, 2-4, Suehiro-cho, Tsurumi-ku, 230-0045 Yokohama, Japan

haruka.nishimura@flow.me.es.osaka-u.ac.jp

Sub- and super-synchronous self-excited vibrations due to axial clearance flows were observed in a columnar rotor with an upstream seal in experiments. A smaller clearance on the downstream seal had a larger effect of stabilizing the rotor. In computations, it was found that the rotordynamic fluid force tangential to the whirling orbit, which is caused as a response to the vibrations (whirling motions), destabilizes the rotor in the case of the upstream seal and stabilizes the rotor in the case of the downstream seal. It was clarified in the 1-D flow model that the tangential rotordynamic fluid force is mainly caused by an inertia of the clearance flow.

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