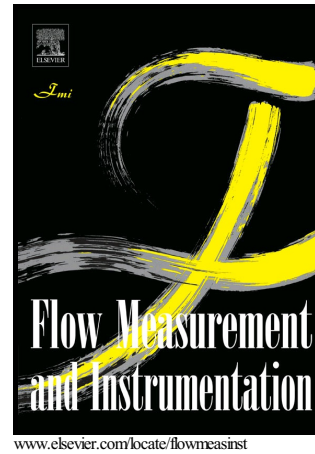


Author's Accepted Manuscript

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PII: S0955-5986(17)30331-X
DOI: <https://doi.org/10.1016/j.flowmeasinst.2017.12.011>
Reference: JFMI1395

To appear in: *Flow Measurement and Instrumentation*

Received date: 2 August 2017
Revised date: 11 December 2017
Accepted date: 28 December 2017

Cite this article as: Edward Lisowski, Grzegorz Filo and Janusz Rajda, Analysis of flow forces in the initial phase of throttle gap opening in a proportional control valve, *Flow Measurement and Instrumentation*, <https://doi.org/10.1016/j.flowmeasinst.2017.12.011>

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Analysis of flow forces in the initial phase of throttle gap opening in a proportional control valve

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Abstract

The main objective of this article was to analyse flow forces acting on a spool of a proportional control valve in the initial phase of the spool gap opening. Accordingly, modification of the spool geometry has been proposed in order to reduce flow force values. The modification consisted in making small circular undercuts at the apex of main triangular grooves, which were made on the spool. The undercuts were made in order to improve flow characteristics, for the gap width less or equal to 0.40 mm. Two arrangements of undercuts were tested. In the first version the undercut was made only on one groove, while in the second version two undercuts were located symmetrically on both sides of the spool. Simulations were carried out by the means of CFD methods and allowed both axial and radial flow forces to be determined. The simulation results showed that the use of a single undercut allowed the valve to operate at a very low flow. However, a significant radial force asymmetry

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