Visualization of Taylor–Dean flow in a curved duct of square cross-section

Kyoji Yamamoto\textsuperscript{a,}*, Xiaoyun Wu\textsuperscript{b}, Kazuo Nozaki\textsuperscript{b}, Yasutaka Hayamizu\textsuperscript{b}

\textsuperscript{a}Department of Mechanical Engineering, Faculty of Engineering, Okayama University, 3-chome 1-1, Tsushima-cho, Okayama 700-8530, Japan

\textsuperscript{b}Graduate School of Natural Science and Technology, Okayama University, Japan

Received 7 December 2004; received in revised form 7 July 2005; accepted 9 September 2005

Communicated by Y. Tsuji

Abstract

The secondary flow in a curved duct of square cross-section is investigated experimentally using a visualization method. Three walls of the duct (except the outer wall) rotate around the center of curvature and an azimuthal pressure gradient is imposed. Photographs of the flow in a cross-section at 180° downstream from the curved duct entrance are taken by changing the flux (Dean number) at a constant rotational speed (Taylor number) of the duct walls. Several types of secondary flow are detected. The variation of the flow patterns with change of flow parameters is compared with that of numerical calculations and is found to be in good agreement. The diagram showing types of secondary flow patterns in the Taylor–Dean number plane is obtained.

© 2005 Published by The Japan Society of Fluid Mechanics and Elsevier B.V. All rights reserved.

\textit{PACS}: 47.15.–x; 47.60.+i

\textit{Keywords}: Taylor–Dean flow; Secondary flow; Curved duct; Rotating duct; Visualization

* Corresponding author. Tel.: +81 86 279 6810; fax: +81 86 279 6810.
\textit{E-mail address}: yamamoto_kyoji@world.ocn.ne.jp (K. Yamamoto).

0169-5983/$30.00 © 2005 Published by The Japan Society of Fluid Mechanics and Elsevier B.V.
All rights reserved.