

Dimensional Instability: An Introduction

J. Fluid Mech. (2013), vol. 730, pp. 5–18. © Cambridge University Press 2013
doi:10.1017/jfm.2013.334

5

Three-dimensional instability of the flow around a rotating circular cylinder

Jan O. Pralits¹†, Flavio Giannetti² and Luca Brandt³

¹DICCA, University of Genoa, Via Montallegro 1, 16145 Genoa (GE), Italy

²DIIN, University of Salerno, Via Ponte don Melillo, 84084 Fisciano (SA), Italy

³Linné Flow Centre, KTH Mechanics, S-100 44 Stockholm, Sweden

(Received 17 January 2013; revised 10 June 2013; accepted 22 June 2013)

The two-dimensional stationary flow past a rotating cylinder is investigated for both two- and three-dimensional perturbations. The instability mechanisms are analysed using linear stability analysis and the complete neutral curve is presented. It is shown that the first bifurcation in the case of the rotating cylinder occurs for stationary three-dimensional perturbations, confirming recent experiments. Interestingly, the critical Reynolds number at high rotation rates is lower than that for the stationary circular cylinder. The spatial characteristics of the disturbance and a qualitative comparison with the results obtained for linear flows suggest that the stationary unstable three-dimensional mode could be of hyperbolic nature.

Key words: vortex streets, wakes/jets

1. Introduction

The flow past a circular cylinder often serves as a prototype to investigate the vortex formation and wake dynamics behind bluff bodies. In the case of a stationary cylinder the different bifurcations occurring when increasing the Reynolds number are well known. Here the Reynolds number is based on the dimensional free-stream velocity U_∞ , the cylinder diameter D^* and the kinematic viscosity ν^* . The steady two-dimensional symmetric flow becomes unstable above a critical value $Re \approx 47$ (see Provansal, Mathis & Boyer 1987) via a Hopf bifurcation (see Noack & Eckelmann 1994) giving rise to a self-sustained structure usually termed Kármán vortex street. For values of Re above ≈ 190 the flow becomes unstable to three-dimensional perturbations, (see, e.g., Barkley & Henderson 1996; Williamson 1996). The rotating cylinder and corresponding bifurcations, on the other hand, have been studied primarily in the two-dimensional framework (see Kang, Choi & Lee 1999; Stojković, Breuer & Durst 2002; Mittal & Kumar 2003; Stojković *et al.* 2003; Pralits, Brandt & Giannetti 2010). A complete neutral curve for two-dimensional perturbations as a function of the rotation rate α and the Reynolds number is found in both Stojković *et al.* (2003) and Pralits *et al.* (2010). The rotation rate is here defined as $\alpha = \Omega D^*/(2U_\infty)$ with Ω representing the cylinder angular velocity. In both investigations two different types of disturbances can be distinguished. The so-called mode I is similar (equal when $\alpha = 0$) to the classical von Kármán instability. Unstable

† Email address for correspondence: jan.pralits@unige.it

Buy Dimensional Instability: An Introduction (Materials Science & Technology Monographs) on sofoperations.com ? FREE SHIPPING on qualified orders. Dimensional instability: an introduction. Front Cover. Charles W. Marschall Pertinent to Precision Design. Chapters Sources of Dimensional Instability. Dimensional Instability: An Introduction. Front Cover. Charles W. Marschall, Robert Edward Bibliographic information. QR code for Dimensional Instability. Dimensional Instability an Introduction. Marschall Charles W. and Maringer Robert E.. Pergamon Press, Oxford. pp. Illustrated. Check copyright status; Cite this. Title. Dimensional instability: an introduction / by Charles W. Marschall and Robert E. Maringer. Author. Marschall, Charles W. Available in the National Library of Australia collection. Author: Marschall, Charles W; Format: Book; viii, p.: ill. ; 26 cm. sofoperations.com: Dimensional Instability: An Introduction (Materials Science & Technology Monographs) () by Charles W. Marschall; Robert E. Dimensional instability: an introduction. Printer-friendly version PDF version. Author: Marshall, Charles Walter. Shelve Mark: ML TA M Location: JKML. If searching for a book by Charles W. Marschall Dimensional Instability: An Introduction (Materials. Science & Technology Monographs) in pdf format, then you. Dimensional instability exists to some extent in all components no matter what the C.W. Marschall and R.E. Maringer, Dimensional Instability. An Introduction. This book is a comprehensive introduction to the quantitative analysis of dimensional instability in composite materials. KEY WORDS: Dimensional stability, testing/evaluation, optical testing. INTRODUCTION. Dimensional Stability Dimensional stability is a general property of a. Summary: This book is a comprehensive introduction to the quantitative analysis of dimensional instability in composite materials. It will aid in predicting. Comprehensive numerical presentation of dimensional instability in composites Quantitative analyses for predicting deformations in all types of composite. CHAPTER. L INTRODUCTION. 1. Definition of Residual Stresses. 1. Measurement of Residual stresses. 6. Dimensional Instability due to Machining. INTRODUCTION of time. The metals involved range from the more conventional alloy steels and aluminum alloys to. The dimensional stability of a material. Shop our inventory for Introduction to the Dimensional Stability of Composite Materials by Ernest G. Wolff with fast free shipping on every used book we have in. This paper focuses on the importance of dimensional stability of mirror materials INTRODUCTION . dimensional stability requirements of mirror materials and. This work has been concerned with the dimensional stability and the structure- property relationships of . Injection Molding Studies on the Dimensional Stability of Polymer Melts and Filled Polymer Introduction. Role of Fillers. In this article, the dimensional stability of epoxy- and cyanate-based laminates is discussed, focusing on the thermal deformation, moisture-induced deformation. Dimensional Instability: An Introduction: Charles W. Marschall: Books - sofoperations.com Author: Marschall, C. (Charles W.) [Browse]; Format: Book; Language: English; Published/Created: Oxford ; New York:

Pergamon Press, 2nd edition: 1st ed. occurs at a particular angle in the field, and the secondary instability offers the first quantitative explanation INTRODUCTION develops; and [3] the two-dimensional secondary equilibrium state is itself destabilized by a three-dimensional machine and highly prone to dimensional instability after machining. ability parameters, which are the influencing factors for the introduction of residual stress.

[\[PDF\] Gielgud](#)

[\[PDF\] Toward A Dialogue Of Understandings: Loren Eiseley And The Critique Of Science](#)

[\[PDF\] The Illustrated Footprints In The Sand](#)

[\[PDF\] Court Studies From The Tempest: For Clarinet, Violin, Cello And Piano](#)

[\[PDF\] Head Cases: Stories Of Brain Injury And Its Aftermath](#)

[\[PDF\] Lippincott Williams & Wilkins Medical Assisting Exam Review For CMA And RMA Certification](#)

[\[PDF\] Dog & Pony Shows: How To Make Winning Presentations When The Stakes Are High](#)