

Lecture Notes in Mechanical Engineering

Volodymyr Tonkonogyi ·

Vitalii Ivanov · Justyna Trojanowska ·

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Predrag Dasic *Editors*

Advanced Manufacturing Processes

Selected Papers from the Grabchenko's
International Conference on Advanced
Manufacturing Processes
(InterPartner-2019),
September 10–13, 2019,
Odessa, Ukraine

 Springer

Lecture Notes in Mechanical Engineering

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ISSN 2195-4356

ISSN 2195-4364 (electronic)

Lecture Notes in Mechanical Engineering

ISBN 978-3-030-40723-0

ISBN 978-3-030-40724-7 (eBook)

<https://doi.org/10.1007/978-3-030-40724-7>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This volume of Lecture Notes in Mechanical Engineering contains selected papers presented at the Grabchenko's International Conference on Advanced Manufacturing Processes (InterPartner-2019), held in Odessa, Ukraine, on September 10–13, 2019. The conference was organized by the Odessa National Polytechnic University, National Technical University “Kharkiv Polytechnic Institute,” Sumy State University, and International Association for Technological Development and Innovations.

InterPartner-2019 focuses on promoting research and developmental activities, intensification of scientific information interchange between researchers, developers, and engineers. The book was organized in three parts, according to the main conference topics: (1) Manufacturing Engineering, (2) Materials Engineering, and (3) Mechanical Engineering.

InterPartner-2019 received 101 contributions from 13 countries around the world. After a thorough peer-review process, the program committee accepted 63 papers, written by authors from 11 countries. Thank you very much to the authors for their contribution. These papers are published in the present book, achieving an acceptance rate of about 62%.

We would like to take this opportunity to thank members of the program committee and invited external reviewers for their efforts and expertise in contribution to reviewing, without which it would be impossible to maintain the high standards of peer-reviewed papers.

Thank you very much to keynote speakers: Ivan Kuric (Slovak Republic), Slawomir Luscinski (Poland), Milan Edl (Czech Republic), Athanasios Mamalis (Greece), Predrag Dasic (Serbia), and Vadym Stupnytsky (Ukraine) for sharing their knowledge and experience.

We appreciate the partnership with Springer, StrikePlagiarism, and EasyChair for their support during the preparation of InterPartner-2019.

Thank you very much to InterPartner Team. Their involvement and hard work were crucial to the success of the conference.

InterPartner's motto is "Science unites people together".

September 2019

Volodymyr Tonkonogyi

Vitalii Ivanov

Justyna Trojanowska

Gennadii Oborskyi

Milan Edl

Ivan Kuric

Ivan Pavlenko

Predrag Dasic

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Manufacturing Engineering

Mathematical Modeling of the Process of the Interaction of the Cutting Diamond Disk with the Environment

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Abstract. Cutting of solid construction materials during repair and restoration work is carried out with diamond discs and CBN discs on a metal bond with speeds up to 80 m / s. The cutting process is accompanied by significant heat generation, as a result of which the cutting disc heats up intensively. When heated to a temperature of 500–600 °C, the strength characteristics of the disk are halved, which can lead to rupture and seizure of the disk and loss of the diamond layer. Disk heating temperature should not exceed 600 °C. The operating time of the diamond cutting disc is the time during which it is heated during continuous operation to a temperature of 600 °C. The cooling media used in cutting are intensively discarded by the air flows of the boundary layer of air that circulate near the rotating circle. Knowing the speed and dimensional characteristics of these flows, we can develop a rational cooling system. The purpose of the study is to determine the conditions of transportation of cooling media, ensuring their guaranteed entry into the cutting zone to create the maximum cooling effect. In work with the help of mathematical modeling defined the speeds of flowing air in the near-wall area and in the area tangential to the disk. The thickness of the air layer, which rotates at a speed of up to 0.5 circle speed was determined, taking this value as the “boundary layer thickness”. The change in air pressure in the cutting zone between the cutting grains was determined too. It is established that air pressure can vary from 0.5 - 1.7 MPa. In this regard, the cooling medium supplied under the circle, inevitably displaced from the cutting zone. In order for the cooling medium to penetrate into the cutting zone, it must be fed under a pressure that exceeds the air pressure in the cutting zone.

Keywords: Boundary Layer, Air Pressure, Boundary Layer Thickness, Cutting Zone, Mathematical Modeling, Cooling Media, Operating Time, Diamond Disc.

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