

Title of Presentation

Intelligent Perception and Precise Control Method of Slag Removal Robot for Non-Ferrous Metal Casting Process

The non-ferrous metal casting process is a process, which molten liquid metal is cast, cooled and crystallized into solid metal ingots in the casting mould. The metal ingot casting process is in a production environment with high temperature, strong toxicity and high risk. At present, it relies on manual operation to remove the oxide slag, which leads to high labour intensity, high safety risks and unstable product quality. In view of the urgent need to realize automatic operation in the non-ferrous metal casting process, the intelligent perception method based on multi-source information fusion of robot vision signal and force perception is proposed to realize online and accurate detection of the shape of metal ingot mould and semi-solid oxide slag, and the surface flatness of ingot after slagging. According to the characteristics of slag-raking process and operation requirements, the real-time trajectory planning and precise control methods of robots based on visual/force perception information are proposed. And the intelligent robot operation system is developed, which has been used to the intelligent slag-raking operation in the casting process.

About the author

Degang Xu received the Ph.D. degree in control science and engineering from Zhejiang University, China, in 2007. From 2010 to 2013, he was a Postdoctoral Fellow with Central South University. He was with the Department of Electrical Engineering, University of Florida, United States of America, from 2013 to 2014. He is currently a Full Professor with Central South University. His current research interests include modelling and optimal control of complex industrial process, robots control system, and intelligent control system. Prof. Xu has published more than 90 papers on the IEEE Transactions on Industrial Electronics, IEEE Transactions on Cybernetics, and top international conferences. He has authored 2 research monographs. He is also the inventor of more than 30 patents. He was honored "Hunan Furong Young. Scholar" in 2022. He has established a very solid link with many Chinese industries including the field of the online detection technology intelligent control methods for Non-Ferrous metal production, intelligent systems for special construction machinery and equipment. He won the Second Prize of Science and Technology Progress Award from the Nonferrous Metals Society of China in 2022, First Prize of Science and Technology Progress Award from The Quality Evaluation Society of China in 2017, respectively.