

Combinatorial Sequence Model for Effective Capacity Utilization in Ajaokuta Steel Complex

Nwanya Stephen, Oluseyi Ajayi and Olatunji Obafemi

Department of Mechanical Engineering
Covenant University

Canaanland P. O. 1023, Ota, Ogun State, Nigeria

Stephen.nwanya@covenantuniversity.edu.ng, oluseyi.ajayi@covenantuniversity.edu.ng

Abah Andrew Abutu

Department of Mechanical Engineering
University of Nigeria Nsukka

Enugu State, Nigeria

adabajane@yahoo.com

Abstract

The developed model and heuristic solution approach are used to eliminate material waste experienced in scheduling of continuous caster process, provide more responsive steel production at lower unit cost and effective capacity utilization. In steel making, the molten steel passes through a continuous caster to form large steel slabs, which are rolled into coils and rods at the finishing. Presently, at Ajaokuta steel complex, the issue seems to have defied solutions because the complex lacks effective and efficient scheduling tools to tackle it. **The methodology of winner determination using a combinatorial auction based-heuristic approaches to solve the aforementioned problem is applied. The scheduling problem in continuous casting stage was formulated as a linear integer program to determine the scheduling sequence for different charges. Then bids are obtained for sequencing the charges. Next, a heuristic approach is used to evaluate the bids.** Combinatorial auction based approach minimized the large search space and discontinuity encountered during optimal solution. The computational results show that the algorithm obtained optimal solution of 15 tonnes in 35 minutes of 15 charges per shift. Also, there is a 43% reduction in production cost per tonne. These are substantial improvements by and contributions of this study.

Keywords: charges, continuous caster, combinatorial auction, scheduling model, steel slab.

Biography

Dr S. C. Nwanya has been working as a professional engineer for over 24 years. His wide variety of experiences in this profession includes teaching introductory engineering management to undergraduates, working as a research supervisor to postgraduate students, and as a research analyst in the public sector. Dr S. C.

Nwanya studied at the following Universities: the Federal University of Technology, Owerri, Nigeria; University of Nigeria, Nsukka, Nigeria; and Università' Degli Studi di Udine, Italy, obtaining Bachelor of Engineering (Hons.) degree in 1991, a Master of Engineering degree in 1998 and a doctorate in Tecnologie Chimiche ed Energetiche in 2008, respectively. He has served on several committees that focus on engineering education. He currently teaches as a faculty staff and senior lecturer at the Covenant University in Ota, Nigeria since August 2015. He is active in many professional bodies and a registered member of Council for the Regulation of Engineering in Nigeria (COREN).

Dr. Oluseyi O Ajayi is an Associate Professor, and current Head of the Department of Mechanical Engineering at the Covenant University, Ota in Ogun State, Nigeria. Dr. holds a Bachelor of Engineering degree from Obafemi Awolowo University, Ile-Ife (1998), a Master of Engineering in Mechanical Engineering from University of Nigeria Nsukka (2004) and PhD in Mechanical Engineering from Covenant University, Ota Nigeria (2011).

He has published over 40 journal and conference papers. His research interest include Renewable energy and Low Carbon Development; Machine Design; Stress and Failure analyses; Vibration and Acoustics as a condition monitoring; Materials and Corrosion studies, industrial material scheduling and Transportation. Dr. Ajayi has successfully supervised 5 Masters and 3 Ph. D students. He is a member of The Nigerian Society of Engineers. He is a registered engineer with Council for the Regulation of Engineering in Nigeria (COREN).