

Analysis of Roller Chain Drive System with Multi-Flexible Body Dynamics Methodology

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Abstract. Finite element method (FEM) was employed to analyze the roller chain drive system which complicated to determine various design factors. The multi-flexible body dynamics (MFBD) method was proposed to model and analysis the roller chain drive system. The roller chain which composed of plates, pins and rollers was meshed with solid elements under the convergence test. The eight tooth sprocket was modeled by rigid body to roll and contact with the roller chain. The dynamic load distribution of the roller chain on the rigid sprocket was compared with the analytical solution. The MFBD simulation results had a good agreement with analytic results which obtained an average error of 12.32%.

1 Introduction

The roller chain has an important role as to transport heavy load of products in along distance of producing line that make wear in chain and sprocket, fracture in chain and drive shaft, chain climbing on sprocket, load noise chain and elongation of chain. These problems are difficult to predict for design and preventive maintenance of the roller chain to protect the breakdown of the producing line. Many factors consist of load, chain tension, contact force between chain and sprocket, useful life, fatigue, alignment and pretension were considered for the chain design [1]. Unfortunately, the roller chain drive system has a lot of components and large movements therefore the design of roller chain was difficult and complicate by using analytical method.

In recent years, finite element method (FEM) was conducted to analyze the roller chain of many transmission applications [2]-[4]. There was the simple methodology to calculate strength of chain components by static analysis but dynamic effects were still indistinct to determine by FEM. The stress and strain which occurred by the element model were deformed, were the finite element simulation results. The multi body simulation (MBS) had been used for dynamic simulation of the chain drive system. The MBS result obtained chain velocity, impulsive and meshing area because the rigid body of chain components was employed for simulation [5], [6]. To calculate load and strength on the dynamic behavior chain simultaneously, the integration between FEM and MBS which known as the multi-flexible body dynamic (MFBD) had developed [7]-[9]. This research had applied MFBD to analyze the roller chain drive

system. The MFBD methodology would be useful to design and predict life time of the roller chain for the producing line in a further work.

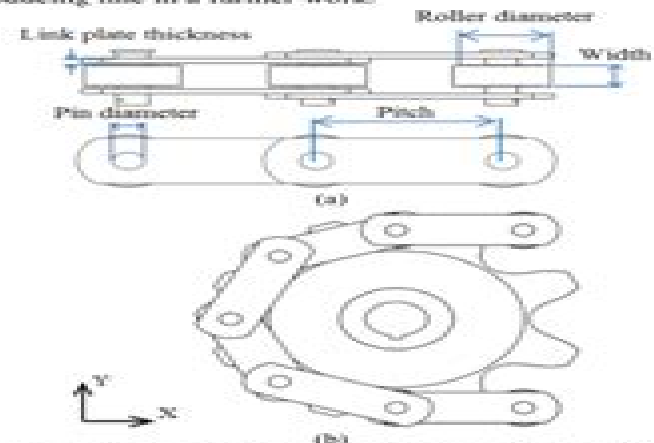


Figure 1. CAD model description of: (a) roller chain and (b) roller chain drive system.

2 Analytical method

The dynamic load distribution in the roller chain was calculated following assumptions: (a) the pitch of the roller chain was equal to the pitch of sprocket; (b) all

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Simulation and Analysis of Roller Chain Drive Systems Sine L. Pedersen, Danish Center for Applied Mathematics and Mechanics, Aalborg Universitet, 2004 Proceedings of the 2nd International Conference on Mechanical System Dynamics Xiaoting Rui, Caishan Liu, 2024-06-18 The 2nd International Conference of Mechanical System Dynamics ICMSD2023 is devoted to Technology Innovations by Understanding Mechanical Dynamics with 18 sessions to promote research in dynamic theories on complex structures multidisciplinary integration and advanced technologies for applications It is held on September 15 in Peking University Beijing China The conference is expected to provide a platform for academic researchers and engineers in the field of mechanical system dynamics to exchange scientific and technical ideas **Tribological Processes in the Valve Train Systems with Lightweight Valves** Krzysztof Jan Siczek, 2016-06-17 Tribological Processes in Valvetrain Systems with Lightweight Valves New Research and Modelling provides readers with the latest methodologies to reduce friction and wear in valvetrain systems a severe problem for designers and manufacturers The solution is achieved by identifying the tribological processes and phenomena in the friction nodes of lightweight valves made of titanium alloys and ceramics both cam and camless driven The book provides a set of structured information on the current tribological problems in modern internal combustion engines from an introduction to the valvetrain operation to the processes that produce wear in the components of the valvetrain A valuable resource for teachers and students of mechanical or automotive engineering as well as automotive manufacturers automotive designers and tuning engineers Shows the tribological problems occurring in the guide light valve seat insert Combines numerical and experimental solutions of wear and friction processes in valvetrain systems Discusses various types of cam and camless drives the valves used in valve trains of internal combustion engines both SI and CI Examines the materials used protective layers and geometric parameters of lightweight valves as well as mating guides and seat inserts Multibody Mechatronic Systems Marco Ceccarelli, Eusebio Eduardo Hernández Martínez, 2014-08-19 This volume contains the Proceedings of MUSME 2014 held at Huatulco in Oaxaca Mexico October 2014 Topics include analysis and synthesis of mechanisms dynamics of multibody systems design algorithms for mechatronic systems simulation procedures and results prototypes and their performance robots and micromachines experimental validations theory of mechatronic simulation mechatronic systems and control of mechatronic systems The MUSME symposium on Multibody Systems and Mechatronics was held under the auspices of IFToMM the International Federation for Promotion of Mechanism and Machine Science and FelbIM the Iberoamerican Federation of Mechanical Engineering Since the first symposium in 2002 MUSME events have been characterised by the way they stimulate the integration between the various mechatronics and multibody systems dynamics disciplines present a forum for facilitating contacts among researchers and students mainly in South American countries and serve as a joint conference for the IFToMM and FelbIM communities Dynamics, Acoustics and Simulations Ray P. S. Han, K. H. Lee, Albert C. J. Luo, 1998

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