

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.

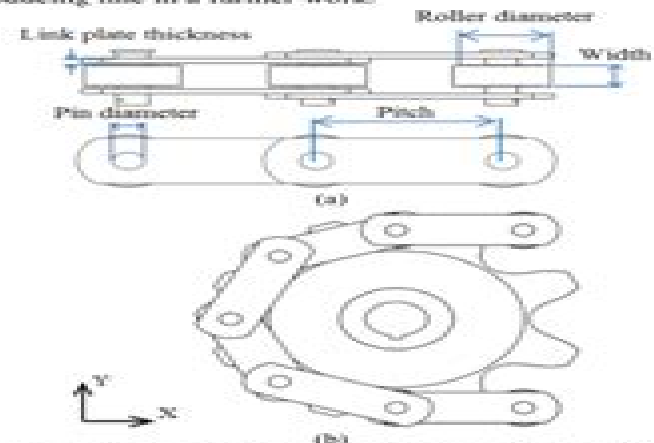


Figure 1. CAD model description of: (a) roller chain and (b) roller chain drive system.

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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**Sine L. Pedersen, Danish Center for
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