Abstract

One of the concerns in belt drive transmissions is the relative sliding (slip) of the belt with respect to the pulley, which results in speed loss, i.e. decrease in the angular velocity of the driven pulley. In this study, the slip behavior of a V-ribbed belt drive with two equal-sized pulleys is investigated by utilizing several experimental methodologies. The individual effects of belt-drive parameters on speed loss are determined using one-factor-at-a-time (OFAT) test method. The relation between the belt-drive parameters and the speed loss is found using response surface method (RSM). Afterwards, the optimum operating conditions are determined via a design optimization procedure. In order to validate the response surface curve, experiments are conducted with arbitrary operating conditions and the measured and predicted values of speed loss are compared. The predictions of the response surface model are also found to be in good agreement with the empirical results presented in the literature. Furthermore, the predicted model looks reasonably accurate based on the analysis of variance (ANOVA) and the residual analysis. Using the response curve, one may estimate the degree of speed loss for similar belt-drives with operating conditions within the range considered in the present study.

Keywords

V-ribbed belt drives; Slip; OFAT; RSM; Design optimization; ANOVA

Corresponding author. Tel.: + 90 212 359 7196.