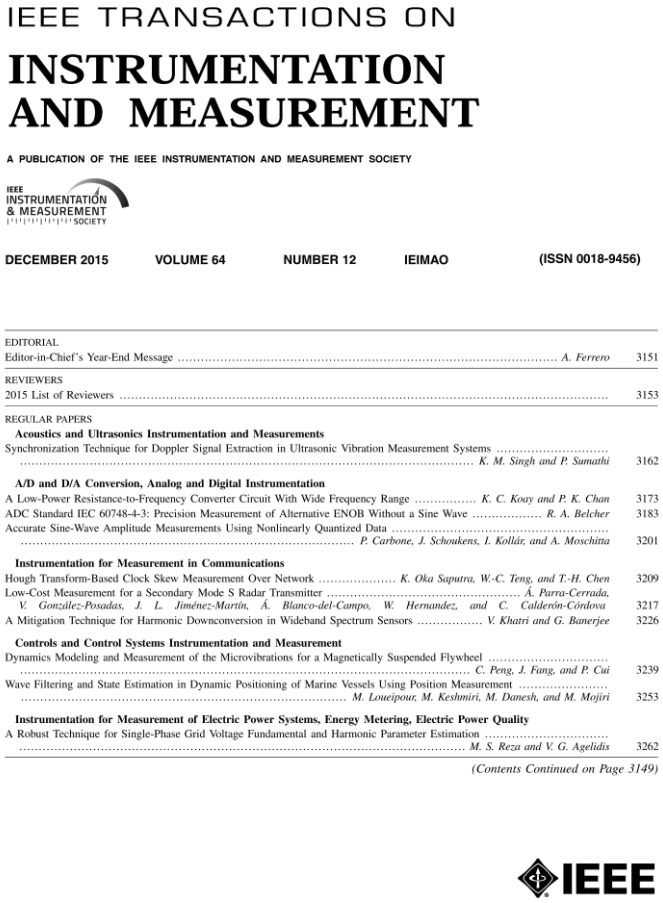

IEEE TRANSACTIONS ON

INSTRUMENTATION AND MEASUREMENT

A PUBLICATION OF THE IEEE INSTRUMENTATION AND MEASUREMENT SOCIETY

IEEE INSTRUMENTATION & MEASUREMENT SOCIETY

DECEMBER 2015 VOLUME 64 NUMBER 12 IEIMAO (ISSN 0018-9456)

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IEEE

Title	Hough Transform-Based Clock Skew Measurement Over Network
Author	Komang Oka Saputra, Wei-Chung Teng, and Tsung-Han Chen
Abstract	The accurate clock skew measurement of remote devices over network connections is crucial to device fingerprinting and other related applications. Current approaches use the lower bound of offsets between the target device and the measurer to estimate clock skew; however, the accuracy of estimation is severely affected when even a few offsets appear below the crowd of offsets. This paper adopted the Hough transform to develop a new method, which searches for the densest part of the whole distribution. This method is effective in filtering out the upper and lower outliers such that the skew values derived from the remaining offsets are stable, even when lower outliers occur, or when the measuring time is not long enough for current approaches to achieve stable results. The experimental evaluation of the proposed method has been conducted in order to compare its performance with that of linear programming algorithm (LPA) and two other approaches. During the five consecutive measurements of 1000 offsets each, skews of the proposed method varied within the range of 0.59 ppm, whereas LPA resulted in the range of 0.89 ppm. Both ranges increased to 1.34 and 63.93 ppm, respectively, when the lower bounds encountered interference from lower outliers
Keywords	Clock skew, delay jitter, Hough transform, linear programming, low outlier
DOI	10.1109/TIM.2015.2450293
Online link	http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7163613