Title	Vibro-indentational hardness testing
Sub Title	
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Publisher	慶応義塾大学藤原記念工学部
Publication year	1970
Jtitle	Proceedings of the fujihara memorial f aculty of engineering keio university Vol.23, No.96 (1970.) ,p.163- 163
JaLC DOI	
Abstract	
Notes	Summaries of Doctoral Theses
Genre	Departmental Bulletin Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO50001004-00230096-0163

Vibro-indentational Hardness Testing

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In this thesis, "vibro-Brinell hardness" is defined in order to estimate the resistance of the plastic deformation of materials under vibrational loads. The vibro-indentation with spherical indenter on low and medium-carbon steels was performed in ultrasonic (20 KHz) and in low frequency (50 Hz) ranges in order to investigate the effects of frequency and carbon percentage on the vibro-Brinell hardness. Experimental results show that this method of the hardness testing is useful as a simulative test of the plastic working under the ultrasonic and low frequency pulsating compressive load. For the same material the differences of the estimation methods of the vibro-indentational load give different results, as "vibro-soften ing" or "vibro-hardening". Also, the laws of vibro-indentation with spherical indenter were investigated, comparing with the Meyer's law for the statical case. From the experiments, it has been made clear that Meyer's law is still valid also for vibro-indentation, if the Meyer coefficient k and the index n are chosen as the functions of load amplitude and frequency, instead of constant values in the original law;

$$P=k(\alpha P_a)\cdot d^{n(\alpha P a)}$$

where, α is the function of frequency. It has been also shown that the above equation can be reduced to Meyer's law with the "load superposition" hypothesis, provided that the value of α is taken as 0.5 for the frequency of 20 KHz, and as 1.0 for 50 Hz.