



UNIVERSITI PUTRA MALAYSIA

***VIBRATION ANALYSIS OF SIMPLY SUPPORTED
BEAM-TYPE VIBRATION ABSORBER***

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**VIBRATION ANALYSIS OF SIMPLY SUPPORTED BEAM-TYPE
VIBRATION ABSORBER**

**By
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**Thesis Submitted to the School of Graduate Studies, University Putra Malaysia,
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Beam-type structures have wide applications, for example civil or mechanical engineering. A simply supported beam is widely used in many areas like bridges and double-beam structures. Excessive vibration in such structures especially at the resonance can cause the structural failure. There are two techniques for suppressing the vibration in the beam-structures that have been studied previously; conventional and continuous vibration absorbers. A beam-type vibration absorber is one of the continuous vibration absorber applications and it is used to suppress the vibration of the main beam. Solving the vibration problem of such kind of structure is difficult and complicated, because the motion equations of the system are coupled. The equations cannot be analytically solved before decoupling them. Therefore, some mathematical transformation and variables variation methods were considered to solve this problem, but it is still under the limitation of identical beams. This means that the analytical method is valid just for identical beams.

The main objective of this research study is to propose an easy and efficient method to solve the problem of the beam absorber system. In addition, there are sub-objectives have been achieved in this thesis; to study the effect elasticity ration of the main and absorber beams, to study the effect of the moving mass inertia on the main beam response, and finally to find the optimum design for the absorber system. The objectives have been achieved by developing the damping factor formulation of dynamic vibration absorber, and by using Time integration method in aided MATLAB. That was in the theoretical study. An experimental test has been performed by using LMS software to observe the performance of the absorber beam in suppressing the main beam vibration. The numerical results showed good agreement with the literature. That means the proposed method has been successfully developed. The experimental results showed good agreement with the numerical results. In other hand, it was found from the results that the effect of the moving mass inertia on the main beam response can be reduced by increasing the layer stiffness. Also, it has been noted that the elasticity ratio can be improved to find the optimum design of the absorber beam system by increasing its value and decreasing the mass ratio of the main and absorber beams. Finally, the numerical results proved that the proposed method is more effective than the methods used in previous works, because it valid for identical and non-identical beams.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**ANALISIS GETARAN UNTUK REDAMAN GETARAN RASUK
SOKONGAN MUDAH**

Oleh

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Struktur jenis rasuk memiliki pelbagai aplikasi di dalam kejuruteraan awam atau kejuruteraan mekanikal. Rasuk disangga mudah banyak digunakan secara meluas di dalam pelbagai struktur seperti jambatan. Getaran berlebihan di dalam struktur terutamanya ketika resonan boleh menyebabkan kegagalan struktur. Terdapat dua kaedah untuk menahan getaran pada struktur jenis rasuk iaitu penyerap getaran biasa dan penyerap getaran berterusan. Penyelesaian masalah getaran struktur adalah sukar dan kompleks, kerana persamaan pergerakan dalam sistem adalah berkesinambungan. Oleh kerana itu, kaedah transformasi matematik boleh digunakan untuk menyelesaikan masalah ini, tetapi penggunaannya terhad kepada jenis rasuk yang sama. Kajian ini menunjukkan cara yang lebih mudah untuk menyelesaikan masalah ini dengan menggunakan kaedah integrasi masa dan formulasi semula nisbah redaman. Melalui kajian ini juga, kesan nisbah ketegaran dan inersia untuk jisim bergerak di atas respon rasuk utama dinilai. Selain itu, kajian eksperimen dijalankan untuk mengesahkan keputusan teori.

Keputusan berangka menunjukkan persamaan yang baik dengan kajian yang sebelumnya. Keputusan eksperimen menunjukkan kesepakatan yang baik dengan

keputusan teori. Juga didapati bahawa nisbah redaman yang dikaji lebih berkesan daripada nisbah redaman dalam kajian terdahulu. Didapati bahawa kesan inersia jisim bergerak pada respon rasuk utama boleh dikurangkan dengan meningkatkan ketegaran lapisan. Walaubagaimanapun, bahan dengan jisim yang rendah dan berketegaran yang tinggi, tidak boleh didapati di pasaran, maka ia memerlukan pengeluaran bahan khas seperti bahan komposit. Namun, kajian ini berguna sebagai panduan dalam merekabentuk sistem peredam jenis rasuk.



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I certify that an Examination Committee met on 11th March 2010 to conduct the final examination of Mothanna Yasen Abd on his Master of Science thesis entitled “Vibration Analysis of Simply Supported Beam-Type Structures” in accordance with the Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Master of Science.

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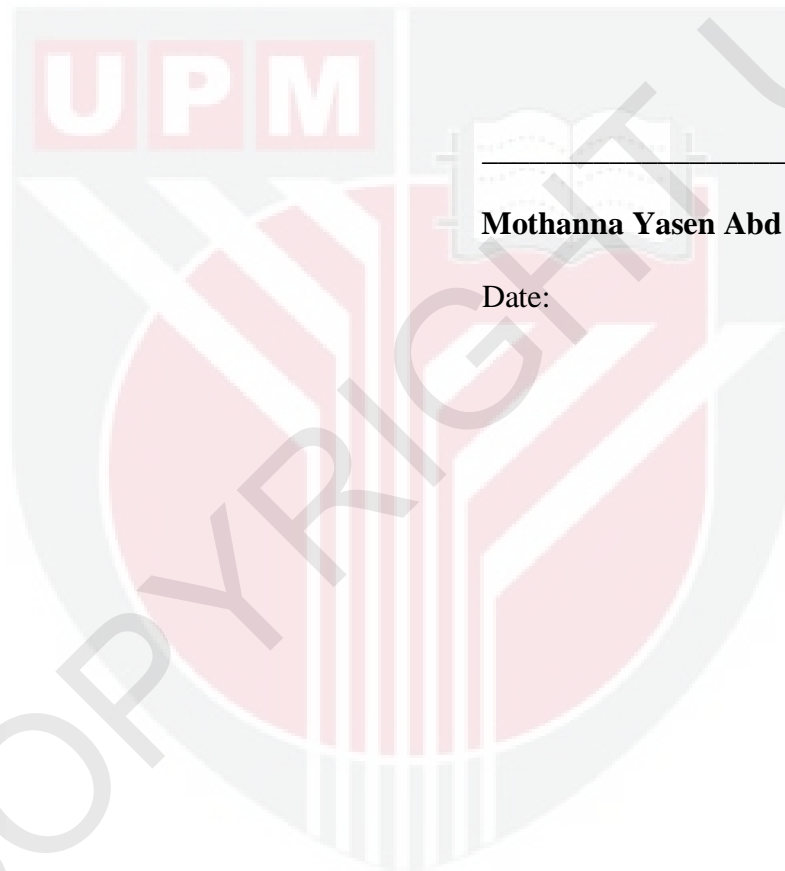
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DECLARATION

I declare that the thesis is my original work except for the quotations and citation which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or at any other institutions.



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