

ANALYSIS OF THE SOUND AND VIBRATION OF SUNDATANG

**PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH**



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UNIVERSITI MALAYSIA SABAH

**FACULTY OF SCIENCE AND NATURAL
RESOURCES
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2015**

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OF SUNDATANG**

RONALD YUSRI BATAHONG



PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

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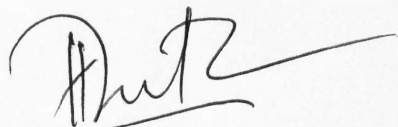
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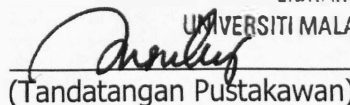
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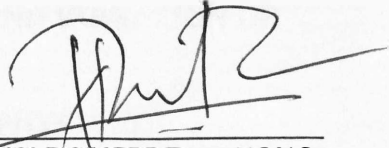


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I hereby declare that the material in this thesis is my own except for quotations, excerpts, equations, summaries and references, which have been duly acknowledged.

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A handwritten signature in black ink, appearing to read 'Jedol Dayou', is written over a horizontal line.

ACKNOWLEDGEMENT

I wish to express my deepest gratitude and appreciation to my supervisor, Associate Professor Dr. Jedol Dayou of the Faculty of Science and Natural Resources, Universiti Malaysia Sabah who has been patient enough to advise, guide and supervise me throughout the past few years. His continuous encouragement provided me the necessary impetus to complete the research and complete this thesis. In this opportunity also I want to thank to all parties that contribute to the completion of this thesis, especially to Mr David Joui, Mr Johori Botohong and Mr. Boginda Mokilin (sundatang maker), and also to my wife Patricia Mongudal and my children Rachel, I'saac, Aa'ron and I'ry, thank you very much.

Ronald Yusri Batahong
16th July 2014



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ABSTRACT

There are many traditional musical instruments available in Sabah, Malaysia. One of them is the sundatang. One of the pressing issues is that the assimilation of this musical instrument with the contemporary music is very limited. This could be associated to limited research on the instrument that may contribute to better understanding and also quality. In this view, the acoustical and vibrational studies of sundatang are really required. The objectives of this research are to study the construction technique, physical, acoustical and vibrational properties of sundatang. This research was carried out by observing the construction technique, measuring the physical, acoustical, and static and dynamic vibrational properties of sundatang. In this research, construction technique of sundatang is first documented and several equations that explaining the physical properties and calculating the fundamental frequency at each frets are formulated. On the other hand, effects of the sound hole, back plate, find tuner cord, string pad, plucking point and plucking force are explained. In the static vibrational measurement (without strings), it is found that fundamental frequency of the top plate and back plate of the acacia sundatang is greater than the vitex sundatang in free edge and in the range of 112 Hz to 230 Hz. However, their fundamental frequency was modified and become lower and closer to each other in the range of 55 Hz to 59 Hz in a clamped edge (attached to its ribs). In the dynamic vibrational measurement (in operating mode), the vibrational properties once again changed when the strings were fixed to the instrument. The natural frequencies of the top plate and back plate are closer to the natural frequencies of the vibrating string, which excites the soundboard to vibrate. The impressive finding in this research is the occurrence of the Different State of Mode (DSM) phenomenon on sundatang soundboard in free condition or fixed to its ribs (static). This DSM disappeared when the strings were fixed in operating mode. The strings modify the vibrational properties of sundatang soundboard. This research has successfully designed a protocol and procedures to study acoustical and vibrational properties of sundatang by the adaptation from the studies of the other modern musical instruments such the guitar and violin. It is hoped that the findings of this research could be used in future studies of the quality advancement of sundatang and also other stringed traditional musical instruments in Sabah.

ABSTRAK

ANALISIS BUNYI DAN GETARAN SUNDATANG

Terdapat berapa alat muzik tradisional di Sabah, Malaysia. Antaranya, ialah alat muzik sundatang. Salah satu isu yang menjadi perhatian berkaitan dengan alat muzik ini ialah asimilasi alat muzik ini dalam muzik komtemporari adalah amat terhad. Ini mungkin dapat dikaitkan dengan kurangnya kajian terhadap alat muzik ini yang boleh menyumbang kepada peningkatan pemahaman dan kualiti yang lebih baik. Dalam hal ini, kajian ciri-ciri akustik dan getaran alat muzik sundatang adalah amat diperlukan. Objektif penyelidikan ini adalah untuk mengkaji kaedah pembuatan, ciri-ciri fizikal, akustik, dan getaran alat muzik sundatang. Penyelidikan ini dijalankan dengan melaksanakan pemerhatian terhadap kaedah pembuatan, mengukur ciri-ciri fizikal, akustik serta getaran statik dan dinamik alat muzik sundatang. Dalam kajian ini, kaedah pembuatan sundatang telah didokumenkan dan beberapa formula untuk menerangkan ciri-ciri fizikal serta untuk mengira frekuensi asas pada setiap fret alat muzik ini telah diformulasikan. Di samping itu juga, kesan lubang bunyi, plat belakang, benang pelaras bunyi, alas tali, titik petikan dan daya petikan telah dijelaskan. Dalam pengukuran getaran statik (tanpa tali), didapati bahawa frekuensi asas bagi plat atas dan plat belakang sundatang acacia adalah lebih tinggi berbanding sundatang vitex, dalam keadaan hujung bebas iaitu pada julat 112 Hz hingga 230 Hz. Walau bagaimanapun, frekuensi asas ini mengalami ubahsuai dan menjadi lebih rendah dengan nilai yang lebih hampir iaitu pada julat 55 Hz hingga 59 Hz dalam keadaan hujung terkapit (dipasang pada tetulang). Dalam pengukuran getaran dinamik (dalam keadaan operasi), ciri-ciri getaran sekali lagi berubah apabila tali telah dipasang pada alat muzik tersebut. Frekuensi asli plat atas dan plat belakang (papan bunyi) adalah menghampiri frekuensi asli tali yang menguja papan bunyi tersebut bergetar. Satu dapatan yang menarik dalam kajian ini ialah penemuan Different State of Mode (DSM) pada papan bunyi sundatang dalam keadaan bebas dan dipasang pada tetulang (statik). DSM ini tidak lagi dikesan apabila apabila tali dipasang pada alat muzik serta dalam keadaan operasi. Tali telah mengubahsuai ciri-ciri getaran papan bunyi sundatang. Penyelidikan ini telah berjaya menghasilkan satu protokol dan prosedur kajian ciri-ciri akustik dan getaran sundatang dengan mengadaptasikan kajian terhadap alat muzik moden seperti gitar dan violin. Adalah diharapkan agar dapatan kajian ini dapat digunakan untuk kajian lanjutan peningkatan kualiti sundatang dan juga alat-alat muzik bertali tradisional yang lain di Sabah.

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