

# 水下爆炸引致巨大空蝕與高速噴流對船舶結構之動態反應分析

許朝鈞、梁卓中、徐慶瑜

E-mail: 364851@mail.dyu.edu.tw

## 摘要

水下爆炸通常有兩個主要階段，分別為爆震波(Shock wave)與氣泡脈動(Bubble pulse)。在爆震波階段，會於接近自由液面處，構成一個爆炸「氣體 - 水 - 空氣」的系統，當爆震波與自由液面的交互作用下，會產生了巨大空蝕區(Bulk cavitation)現象。在氣泡脈動階段，氣泡在收縮與膨脹過程中，加上水的浮力作用下，伴隨發生上浮運動，最後崩潰時引致高速噴流現象。巨大空蝕區的效應與氣泡崩潰引致的高速噴流對水面的船體結構具有一定的損傷程度，故在水下爆炸後船體結構的整體效應分析，必須將巨大空蝕與氣泡崩潰引致高速噴流效應之影響納入考量。本論文以巨大空蝕與氣泡崩潰引致高速噴流效應為研究對象。利用ABAQUS有限元素軟體為工具，運用CEL(Couple Eulerian-Lagrangian)理論，並與Ramajeyathilagam和Vendhan[34]探討平板在受水下爆炸衝擊後，平板變形之實驗結果進行驗證；最後以某型船艦為對象，分別探討船體結構在巨大空蝕區墜落與氣泡崩潰引致高速噴流撞擊至船體結構之損傷分析；本論文研究之成果可提供船艦結構設計者進行船體結構設計時使用。

關鍵詞：水下爆炸、巨大空蝕區、高速噴流

## 目錄

封面內頁 簽名頁 中文摘要.....	iii
ABSTRACT.....	iv 誌
謝.....	v 目
錄.....	ix 圖目
錄.....	xii 表目
錄.....	xvi 第一章 緒
論.....	1 1.1 前
言.....	1 1.1.1 爆震波傳遞至自由
面.....	2 1.1.2 震波反射引致巨大空
蝕.....	2 1.1.3 氣泡脈動..... 3 1.2
文獻回顧.....	4 1.2.1 巨大空蝕相關參考文
獻.....	4 1.2.2 氣泡崩潰引致噴流相關參考文
獻.....	6 1.3 本文目的..... 8 第二
章 理論基礎.....	17 2.1 ABAQUS簡
介.....	17 2.1.1 前處
理(Preprocessing).....	18 2.1.2 模擬計
算(Simulation).....	19 2.1.3 後處
理(Postprocessing).....	20 2.2 ABAQUS顯示動態分析(Explicit Dynamic
Analysis).....	20 2.3 Couple Eulerian-Lagrangian理
論.....	22 2.4 巨大空蝕理論..... 24
2.4.1 巨大空蝕區上邊界.....	25 2.4.2 巨大空蝕區下邊
界.....	26 第三章 實例驗
證.....	29 3.1 巨大空蝕區域驗
證.....	29 3.2 應用CEL分析方法驗
證.....	29 3.2.1 模型介
紹.....	30 3.2.2 材料參
數.....	31 3.2.3 實驗條
件.....	31 3.2.4 結果與討
論.....	32 第四章 水下爆炸引致巨大空蝕區造成船艦結構墜落時之結構動態
效應分析.....	44 4.1 模型介
紹.....	44 4.2 材料參數與元素介

紹.....	44	4.3 邊界與負載設
定.....	46	4.4 結果與討
論.....	46	4.4.1 船體結構損傷分
析.....	47	4.4.2 流體動態反
應.....	50	4.4.2.1自由液面最外側流體速度動態歷
程.....	50	4.4.2.2巨大空蝕區最外側流體速度動態歷
程.....	51	第五章 船體結構承受高速噴流負荷時之結構動態效應分
析.....	64	5.1 模型介紹.....64
數與元素介紹.....	64	5.2 材料參
定.....	65	5.3 邊界與負載設
論.....	65	5.4 結果與討
構.....	65	5.4.1噴流速度130m/s撞擊船體結
構.....	68	5.4.2噴流速度170m/s撞擊船體結
論.....	71	5.4.3結果比較與討
望.....	86	第六章 結論與未來展
論.....	86	6.1船體結構在巨大空蝕區墜落時之動態效應分析結
論.....	87	6.2船體結構承受高速噴流負荷時之動態效應分析結
文獻.....	91	6.3總結論與未來展望.....89 參考
錄.....	95	附

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