

研究生:	林俊豪
研究生(英文姓名):	Chun-Hao Lin
論文名稱:	大空間排煙口設置參數對排煙性能影響之研究
英文論文名稱:	Modeling of the Effects of Exhaust Outlets on the Smoke Exhaust Performance of L
指導教授:	蔡尤溪
學位類別:	碩士
校院名稱:	國立臺北科技大學
系所名稱:	冷凍空調工程系所
學號:	92458508
學年度:	93
語文別:	中文
論文頁數:	91
關鍵詞:	中庭；拉穿效應；排煙指數
英文關鍵詞:	Atrium；plug-holing；smoke exhaust index
被引用次數:	0

【摘要】

大空間建築是近年最受歡迎的建築之一，舉凡台北101、京華城、中正機場等等，讓使用者有明亮、舒適的感覺，常是人群眾多聚集之地，故其火災緊急時之煙控性能要求非常重要。因為挑空中庭空間的型態，在火災發生時，會的煙流迅速的由下往上竄升，形成整棟建築物陷於火煙急速擴大及擴散的危險當中。而目前我國現行之典型條例式電腦模擬及現場全尺寸實測結果作防煙性能式分析。近年來由於電腦科技進步，個人電腦已經可以負荷大多數之FDS(NIST所發展之Fire Dynamics Simulator)火災模擬軟體作為分析工具。本研究考慮大空間中庭中發生之火災對風量等對於大空間排煙之影響，並使用排煙指數分析中庭拉穿效應(plug-holing)對排煙效率的影響大小，並設溫度之設置參數與建議，作為日後性能式設計與大空間火災實驗規劃之用。

【英文摘要】

Buildings with atria or large spaces are becoming popular lately, such as Taipei 101 trade center, shopping malls bright feeling. However the smoke control requirements and performance are important as they are often heavily smoke plume will rise and may spread quickly to other parts of the building and cause danger to people inside the for an atrium fire. Therefore, computer analysis and field experiments are often need to evaluate the fire safety design modeling method to analyze parameters that will affect the smoke control performance for an atrium. This study is Simulator) as developed by NIST(National Institute of Standards and Technology). Parameters such as locations, volume, etc are evaluated in this study. Plugholing effects are studied. A new performance index the smoke exhaust on the effective smoke exhaust volume. Measurement trees were setup in the computer model for observation of smoke exhaust outlet location has great effects on smoke exhaust. Also, effective smoke exhaust volume is not the volume. Performance curves for various cases are provided for reference in actual design.

【論文目次】

摘 要 i
ABSTRACT ii
誌 謝 iii
目 錄 iv
表目錄 vi
圖目錄 vii
第一章 緒論 1
1.1研究背景與目的 1
1.2火災煙流之研究方式 2
1.3研究方法與步驟 3
1.4模擬之限制條件 5
1.5文獻回顧 6

第二章 火災模式之設計	13
2.1火災之發展過程	13
2.2火源設計	15
2.3火災之煙柱流(Plume)	20
2.4煙之填充高度(Height of first indication of smoke)	23
2.5煙層高度判定(Somke layer interface)	24
2.6大空間常見之煙控設計方式	25
2.7拉穿效應(plug-holing)	28
2.8大空間防護與避難安全界定標準	30
第三章 大空間排煙口設置數值模擬	32
3.1 FDS與Smokeview	32
3.2 守恆方程式	34
3.3 格點配置	37
3.4 模擬案例之幾何圖形與邊界條件	40
3.5 本研究所採用之各條件說明	46
第四章 結果與討論	49
4.1單點排煙	52
4.2多點排煙	59
4.3單點排煙與多點排煙之其他比較	64
4.4補氣口參數	71
4.5熱釋放率與建築尺寸參數	78
4.6自然排煙兼機械排煙設置其佈置相對位置比較	85
第五章 結論與建議	87
5.1 結論	87
5.2 未來研究與建議	88
參考文獻	89

[參考文獻]

- [1] Baum, H.R., McGrattan, K.B., Rehm,R.G., “Large Eddy simulations of smoke Movement in Three Dimensio Conference, pp.26-28, 1996.
- [2] McGrattan, K.B., Baum, H.R., Rehm,R.G., “Large Eddy simulations of smoke Movement,” Fire Safety Jou
- [3] McGrattan, K.B., Baum, H.R., Rehm,R.G., Forney,G.P. , Floyd,J.E., Prasad, K. and Hostikka, S., “Fire Dyni Guide. “Technical Report NISTIR 6783, 2002 Edition, National Institute of Standards and Technology , Gaithe
- [4] Baum, H.R., “Large Eddy Simulation of Fires – from Concepts to Computations” , Fire Protection Engineer
- [5] Floyd, J.E., Wiecezorek, C. and Vandsburger, U., “Simulation of the Virginia Tech Fire Research Laboratory l Chemistry and Finite Volume Radiative Heat Transfer,” Proceedings of Interflame ’ 01, Ninth International Fir pp.17-19, 2001.
- [6] Zhang, W., Andrew Hamer, Michael Klassen, Douglas Carpenter, Richard Roby, “Turbulence statistics in a Safety Journal 37 pp.721-752. , 2002.
- [7] Wang, H.Y., Coutin, M., Most, J.M., “Large-eddy simulation of Buoyancy-driven Fire Propagation behind a l Journal 37 pp.259-285. , 2000.
- [8] Petterson, N.M., Assessing the Feasibility of Reducing the Grid Resolution in FDS Field Modeling Fire Engin Charley Fleischmann), University of Canterbury, New Zealand, February 2002.
- [9] 蔡尤溪，「建築防煙計畫及實驗研究子計畫(II)大空間防煙性能模擬與現場實測基準之研究」，內政部建築研究
- [10] NFPA 92B, Guide for Smoke Management Systems in Malls, Atria, and Large Areas, 2000 Edition.
- [11] The BOCA National Building Code, 1987.
- [12] Uniform Building Code, Volume 1, Publisher: ICBO. , 1997.
- [13] International Building Code, International Code Council. , 2000.
- [14] Thomas, P.H. et al. “Investigation into the flow of hot gases in roof venting” , Tech. Paper No.7 Boreham
- [15] McCaffrey, B.J., “Momentum implications for buoyant diffusion flames” , Combustion and Flame, 52(2): p
- [16] Zukoski, E.E., Kubota, T. and Cetegen, B., “Entrainment in Fire Plumes” , Fire Safety Journal, Vol. 3,pp.1
- [17] Heskestad, G., “Fire plume air entrainment according to two competing assumptions” , Twenty-first Symp

Institute, Pittsburgh, Pa., pp. 111-120. , 1986.

[18] Chow, W. K. and Lo, A.C.W., “Scale Modeling Studies on Atrium Smoke Movement and the Smoke Filling 7(2), pp. 56-64, 1995.

[19] Chow, W. K., “A Comparison of the Use of Fire Zone and Field Models for Simulating Atrium Smoke-Filling 1995.

[20] Rho, J.S. & Ryou, H.S., “A Numerical Study of Atrium Fires Using Deterministic Models” , Fire Safety Jou

[21] Klote, John. H, “New Development in Atrium Smoke Management” , ASHRAE Transactions, Vol. 106, Pa

[22] 李訓谷，「大空間中庭建築性能式煙控系統設計分析」，中山大學機械工程系博士論文，2001年。

[23] 廖俊榮，「火災煙柱模式與補氣系統對中庭建築煙控系統設計之影響分析」，中山大學機械工程系碩士論文

[24] Roger Harrison, “Smoke Control in Atrium Buildings-A Study of the Thermal Spill Plume” , Fire Engineerin Michael Spearpoint), University of Canterbury, New Zealand, July 2004.

[25] Yi, L. and Chow, W.K., “Full-Scale Burning Tests of Mechanical Smoke Exhaust in Large Atrium” , ASHR

[26] 霍然，「中庭內煙氣充填和控制的實驗」，兩岸城市建築防災防火與工業安全技術研討會，2005年6月。

[27] Morgan, H.P. and Gardiner, J.P., “Design principles for smoke ventilation in enclosed shopping center” , I

[28] Spratt, D. and Heselden, A.J.M., “Efficient extraction of smoke from a thin layer under a ceiling” , U.K. Joi

[29] Hinckley P.L, “Smoke and heat venting” , SFPE handbook of fire procetion Engineering, 1995.

[30] Lougheed, Gray D. and Hadjisophocleous, Geroge V., “Investigation of Atrium Smoke Exhaust Effectivene

[31] Lougheed, Gray D., Hadjisophocleous, Geroge V., McCartney, C. and Taber, B.C., “Large-scale physical I ASHRAE Transaction, 1999.

[32] Lougheed, Gray D., “Smoke management reseach at NCR” , NCR 2002.

[33] Klote, John. H and Milke, J.A., “Principle of Smoke Management Systems” , ASHRAE and SFPE, 2002.

[34] 行政院災害防救委員會「公共安全管理白皮書」大空間防火安全避難管理，2004年3月。

[35] 陳弘毅，「火災學」，鼎茂圖書出版公司，1996年。

[36] 鍾基強，「性能式煙控與避難系統設計」，全華科技圖書出版公司，2001年。

[37] SFPE Handbook of Fire Protection Engineering,3rd 2002.

[38] 陳俊勳，「建築物火災成長延燒防止技術之性能式設計法研究」，內政部建築研究所，2001年。

[39] NFPA 130, Standard for Fixed Guideway Transit Systems. , 2003 Edition.

[40] Forney, G.P. and McGrattan, K.B., “User’ s Guide for Smokeview Version 4- A Tool for Visualizing Fire D 1017, Aug. 2004.

[41] McGrattan, K.B., Baum, H.R., Rehm, R.G., Forney, G.P., Floyd, J.E., Prasad, K. and Hostikka, S., “Fire D Publication 1019, Feb. 2005.

[42] McGrattan, K.B., “Fire Dynamics Simulator (Version 4) Technical Reference Guide” , NIST Special Public

[43] Morgan, H.P., “Smoke control method in enclosed shopping complexes of one or more stores: A design si
