CAE技術應用於耐壓型油封開發之探討

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ABSTRACT

The sealing system plays an important role in the performance of hydraulic and pneumatic transmission equipments .Whether in automotive,chemical and process,manufaturing, marine or power generation industries,the working environment of the sealing system become more and more demanding.Operational conditions with higher power ,temperature and working speed are expected.Adaptability numbers of lubricants and greases,greater reliability,and extensed running also post great challenges. Hence,it is important for engineers to design an optimal seal that can prevent leakage,corrosion,inflammable or incom-patible fluid under high pressure or temperature on continuous running machinery in a sterile,explosive or other critical environment. This report was based on Design Of Experiment (DOE) and Computer Aide Engineering (CAE) experiments in research of pressure oil seals. Relevant data were collected from the reactions of seals under different pressure environments, so that important parameters and factors can be found.This research has come to the conclusion as following three findings: 1.Seals that are bounded with PTFE can withstand stronger pressure than seals that are made from regular material. 2.Air side of lip angle has tremendous influences on the seal ’ s ability to stand pressure. 3.Response Surface Model can be obtained by gathering the para-meters from thickness and length of the seal lip. It is hoped that the current research will be contributive in designing seals.

Keywords : Pressure Oil Seals ; Design of Experiment Method ; Computer Aide Engineering

Table of Contents

REFERENCES

[1] Heinz k.Muller and Bernards.Nau ,Fluid Sealing Technology , Marcel Dekker , Inc. ,1998.
[2] Simrit Standard Catalogue , Freudenberg,1993.
[3] 近森德重，“密封迫緊技術”，復漢出版社，1982。
[4] Shaft Seals For Dynamic Application, Chicago Rawhide Manufacturing Company, Marcel Dekker,Inc,1996.
[5] SAE Fluid Sealing Handbook Radial Lip Seals , SAE HS-1417,1996 Edition.
[6] Robert V. Brink. , Handbook of Fluid Sealing,McGraw-Hill,Inc,1993.
[7] Buchter Hugo, Industrial sealing technology,John Wiley & Sons,Inc. 1979.
[8]Borwn Meluinw, Seals and sealing handbook,Elsevier Science Publishers Limited,1990.
[9] High Performance Seals , Race — Tec NAK ,1995.
[10] 黃與，橡膠密封件國內外最新技術的發展，Lecture note兩岸工具機高速化及密封技術研討會，臺中，1998。
[11]Automotive sealing , SAE SP-921,1992.
[12] C K .Kim and WJ. Shim , Analysis of Contact Force And Thermal Behaviour Of Lip Seals , Tribology International ,Vol.30 , NO.2.PP.113-119 , 1996.
[13] AG .Fern,A. Mason — Jones , DT.Pham and J .Wang , Finite Element Analysis of A Valve Stem Seal , SAE Paper 980580, 1998.
[14]DT.Pham and J.Wang,Further Finite Element Analysis of Reciprocating Valve Stem Seals,SAE Paper1999-01-0885.
[15] S. Obayashi , Analysis To Reduce The Sliding Friction of Power Steering Rod Seal, SAE Paper 980583 ,1998.
[16]田口玄一原著，小西省三主編，品質評價的S/N比，田口品質工程組翻譯，中國生產力中心出版，民國八十年七月。
[17]田口玄一原著，吉澤正主編，開發設計階段的品質工程，田口品質工程組翻譯，中國生產力中心出版，民國七十九年十一月。
[18]田口玄一原著，橫山僎子主編，品質設計的實驗計劃法，田口品質工程組翻譯，中國生產力中心出版，民國八十年七月。
[19]田口玄一原著，田口氏品質工程概論(針對技術開發的品質工程)，田口品質工程組翻譯，中國生產力中心出版，民國七十九年三月。
[20]鷲尾泰俊原著，蔡明三編譯,實驗計劃法，華泰書局，1993年三月，三版。
[21]吳玉印，實驗計劃法(新版)，中興管理叢書，中興管理顧問公司出版。
[22] Douglas C.Montgomery , Design and Analysis of Experiments, John Wiley and Sons, 3rd edition,1997.
[23]Y.C.Che , Taguchi Experimental Method Applied to Sand Mold Casting , Aero Industry Developmemt Center , R.O.C.,1992.(該文曾獲田口品質工程世界性比賽第二名) [24]黃運火，「田口氏品質工程提昇射出技術水準」，模具工業， p56-67，八十二年六月。
[25]林澤龍，田口方法應用於射出成型製程與螺桿設計，國立中興大學碩士論文，1997。
[26]李成禎、王元元及張永華，田口式實驗法應用於向量控制感應電動機的模式建立與驗證，中正嶺學報，第二十八卷,第二期，pp73-86，民國八十九年三月。
[27]鄭英洲，田口方法推行實務與個案介紹，中國工業工程學刊第九卷第一期，p77-83。
[28]黃永河，卓漢明，絕緣液對鈦合金微細溝槽微能量放電加工特性之影響，中國機械工程學會，第十四屆全國學術論文集，p195-202。
[29]T.N.GOH, Some Strategies For Experimentation Under Operational Constraints, Quality and Reliability Engineering International.VOL.13.,279-283, 1997.
[30] R.Karthikeyan, P.R.Lakshme Narayanan and R.S.Naagarazan, Mathematical modeling for electric discharge machining of aluminum-silicon carbide particulate composites, Journal of Materials Processing Technology,p59-63, 1999.
[31]Jose Marafona, Catherine Wykes, A new method of optimizing material removal rate using EDM with copper-tungsten electrodes , International Journal of Machine Tools and Manufacture, p153-164,2000.
[32]第三屆品質優良案例獎得獎案例精華輯，中國生產力心中編印，p321-459。
[33]朱達宏，IC構裝製程中外觀檢測機器之參數設定研究，朝陽科技大學，碩士論文，1998。
[34]Young, J. Clifton , Blocking, Replication, And Randomization — The Key To Effective Experimentation : A case Study, Quality Engineering , Vo1.9 , No.2 , pp.269-277, 1996-97.
[35]Young, J. Clifton , Quality and Productivity Improvement Using Regression Analysis : A Case Study , Quality Engineering, Vol.9 , No.2, pp.179-186 , 1996-97.
[36]Teresal Lo ’pez-Alvarez, Victor Aguirre-Torres, Improving Field Performance By Sequential Experimentation : A successful Case Study In The Chemical Industry , Quality Engineering , Vo1.9 , No.3, pp.391-403 , 1997 .
[37]Steniberg, David M., Bursztyn, Dizza , “Dispersion Effects in Robust-Design Experiments with Noise Factors”, Journal of Quality Technology, Vo1.26 , No.1, pp.12-20 , January,1994.
[38] 薛少俊，密封元件技術，中國機械工程學會，166期，pp 27-37，77年12月。
[39]郭文化，黃錦鐘譯，油壓密封的方法與特性，機械月刊二十四卷第六期，pp330-337，1998年6月。
[40] 劉明澤，唇型油封的特性與應用，機械月刊第十七卷第二期，pp108-115。80年2月。
[41]賴耿陽譯，最新橡膠材料實務，復漢出版社。
[42]橡膠配方設計概論，台灣區橡膠工業研究試驗中心。
[43] NAK Oil Seal, Catalogue,Mao Shun,1999.

[44]ANSYS 5.5 User Manual.
[45]S. Obayashi and S. Slkai, The Propriety of Quadratic Mooney — Rivlin Model, SAE Paper 980845,1998.
[46]N. Okano, T. Matsuda and M .Takeda ,Prediction Of The Life Of CVJ Boot In Design Stage And Establishment Of An Optimal Design Method With FEA , SAE Paper 980847 ,1998.
[47]J E.Mark, Science And Technology Of Rubber,Academic Press,Inc, Second Edition, 1994.
[48]D. Boast,VA Conveney ,Finite Element Analysis of Elastomers,Professional Engineering Publishing Limited, 1999.
[49] NOK Oil Seal,Cat.no.014.12-98.