


## 2008 年中央研究院「年輕學者研究著作獎」得獎人簡介

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得獎著作名稱：(請以申請時之格式填入)

Compactness of pseudohermitian structures with integral bounds on curvature,  
Math. Ann., volume 334 (2006), **111-142**.

得獎著作簡介：(2000 字左右)

在這篇文章"Compactness of pseudohermitian structures with integral bounds on curvature"，我們證明了一個類比於 3 維保角測距(conformal metrics)的緊緻性定理，它是解決擬赫米特幾何結構的緊緻性問題。

這篇文章是在這一領域的第一篇文章，以前有人處理過，都沒能成功，那是因為在處理 Bochner formula 時有一交錯項很難去控制，因而都失敗了。我們觀察到這一交錯項與一個四階的微分算子的關係，透過對這一算子的深入探討，進而找到了一個克服它的方法。這一個算子我們稱它為 CR Paneitz 算子或 Hirachi 算子。這樣的觀察以及對於 Hirachi 算子的深入瞭解，也有助於後來其他工作的完成；如在 sublaplacian 算子的第一個 eigenvalue 的估計方面，我們發現到在某些 CR 結構下可簡化第一個 eigenvalue 估計的條件，類似的條件在 Li 與 Luk 的文章較為複雜，也似乎較難使用；還有在 3 維 CR 流形的曲率流方面，我們亦得到了在 CR 幾何裏有關全域解存在性的第一篇文章。

總之，這一篇文章的完成，算是在這一領域工作的一個好的開始，它深刻地啟發了我們的一些想法。我們認為 CR Paneitz 算子在擬赫米特幾何是有其決定性的角色的，特別是在低維的情況下。這點可以從我們後續的工作中，總是跟這一算子息息相關看出來。

### 評審簡評：


許多不同的幾何空間經常有類似的定理。例如，在保角測距(conformal metrics)的幾何空間已知有某些緊緻性的定理。這些定理在其他的幾何空間，例如在 Cauchy-Riemann 結構(CR geometry)的空間，是否可以做類似的推廣？

過去有人處理過這類問題，但是並沒有成功。邱鴻麟先生在這篇代表作首次成功的解決這類 CR geometry 的緊緻性定理。他的方法是深入的分析某一類四階的微分算子(即 Hirachi 算子)，利用它來研究 Bochner formula，從而得到緊緻性定理。

邱鴻麟先生的論文對於 CR geometry 在分析與幾何的研究將有深遠的影響。

值得一提的是，邱鴻麟先生是國內自行訓練的博士，他是中原大學畢業的學生，清華大學的碩士與博士(指導教授是中央研究院的鄭日新先生)。土產的博士寫出的論文可以與許多國外名牌大學的博士一較高下，足見台灣學術界近年的實力。

## 2008 Academia Sinica Research Award for Junior Research Investigators

<p>Name: Hung-Lin Chiu</p> 	<p>Education:</p> <p>PhD, Department of mathematics, National Tsing Hua University, 1993~1998</p> <p>MSc, Department of mathematics, National Tsing Hua University, 1989~1991</p> <p>BSc, Department of Applied mathematics, Chung Yuan Christian University, 1985~1989</p> <p>Employer(s)/Job Title(s):</p> <p>Assistant Professor, Department of mathematics, National Central University, 2007~</p> <p>Assistant Professor, Department of Applied mathematics, Chung Yuan Christian University, 2006~2007</p> <p>Postdoctoral member, Institute of Mathematics, Academia Sinica, 2003~2006</p>
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Award publications :

Compactness of pseudohermitian structures with integral bounds on curvature ,  
Math. Ann., volume 334 (2006), **111-142**.

Summary of the Award publications ( around 2000 words ) :

In this paper "Compactness of pseudohermitian structures with integral bounds on curvature", we prove the CR analogue of compactness theorem for conformal metrics. It deals with an important compact problem about the pseudohermitian structures.

This paper is the first to be published in the related field. Actually, this problem has been attempted by several people previously without success, because there is difficulty in controlling a cross term in the Bochner formula. We have found a way to deal with this term by relating it with a fourth order differential operator, which is called the Paneitz operator or Hirachi operator. After looking into this operator, we can overcome the difficulty. The sequential results were done smoothly after that. For example, we simplified the curvature condition to estimate the lower bound of the first nonzero eigenvalue of the sublaplacian in 3-dimensional case. We can also do the estimate when the curvature is negative. For the curvature flow on CR 3-manifold, we also accomplished the first article about the long time existence in CR geometry, and so on.

In conclusion, it is a good thing the finishing of the paper for the field of this geometry. We were greatly illuminated by the way of thinking in this paper. We think the CR Paneitz operator is essential in Pseudohermitian geometry, especially, in 3-dimensional case. This can be shown from our sequential works, which are always related to this operator.