

数学与系统科学研究院  
计算数学所系列学术报告

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报告题目:

**Modelling and fast schemes for  
image processing**

邀请人: 陈志明研究员

时间安排:

**Lecture 1 : August 19 14:00-17:00**

**Lecture 2 : September 2 14:00-17:00**

报告地点: 科技综合楼三层 311

计算数学所报告厅

# **Abstract:**

In this series of talks, we first introduce models for image processing based on partial differential equations. This part will cover the well-known models related to ROF (total variation model), Mumford-Shah model, Euler's elastica model. Then we will give some details in using these models for image processing include: image restruction, image segmentation, noise removal and image inpainting.

In order to use these models for real industrial applications, fast numerical methods are needed. We start with the traditional gradient decent algorithms. Afterwards, we will go through some modern fast numerical schemes including: Dual algorithms, Alternating minimization algorithms, Augmented Lagrangian methods, graph cuts schemes and some fast iterative algorithms that have been proposed recently.

Most part of the talk are based on our research work listed below:

## **A: Books:**

1. Tai, Xue-Cheng; Lie, Knut-Andreas; Chan, Tony F.; Osher, Stanley (eds): **Image Processing based on Partial differential equations**, "Mathematics and Visualization", Heidelberg: Springer Verlag 2006. ISBN 978-3-540-33266-4. 440 pages.

2. Tai, Xue-Cheng, Knot Morkken, Marius Lysaker and Lie, Knut-Andreas (eds), "Scale Space and Variational Methods in Computer Vision", second international conference, SSVM 2009, proceedings. Lecture notes in computer science LNCS 5567, Springer, 2009. ISSN 0302-9743.

Articles: (see [http://folk.uib.no/nmaxt/Tai\\_Home\\_Page/Publications.html](http://folk.uib.no/nmaxt/Tai_Home_Page/Publications.html))

1. Bae, E., Tai, X.-C., Efficient global minimization for the multiphase Chan-Vese model of image segmentation, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Volume 5681 LNCS, 2009, Pages 28-41.

2. Bae, E., Tai, X.-C., Graph cut optimization for the piecewise constant level set method applied to multiphase image segmentation, Lecture

**Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Volume 5567 LNCS, 2009, Pages 1-13.**

**3. Tai, X.-C., Wu, C., Augmented lagrangian method, dual methods and split bregman iteration for ROF model, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Volume 5567 LNCS, 2009, Pages 502-513.**

**4. Johan Lie, Marius Lysaker and Xue-Cheng Tai, A variant of the level set method and applications to image segmentation. Math. Comp. 75 (2006), no. 255, 1155--1174.**

**5. Hodneland, E., Bukoreshtliev, N.V., Eichler, T.W., Tai, X.-C., Gurke, S., Lundervold, A., Gerdes, H.-H., A unified framework for automated 3-D segmentation of surface-stained living cells and a comprehensive segmentation evaluation, IEEE Transactions on Medical Imaging, Volume 28, Issue 5, May 2009, Pages 720-738.**

**6. E. Hodneland, X.-C. Tai, and H. Gerdes, Four-color theorem and level-set methods for watershed segmentation. International Journal of Computer Vision, vol. 82, pp. 264-283, 2009.**

**7. Johan Lie, Marius Lysaker and Xue-Cheng Tai, A Binary Level Set Model and Some Applications to Mumford-Shah Image Segmentation. IEEE Transection on image processing, vo. 15, no. 5, pp. 1171-1181, 2006. Download pdf file.**

**8. Marius Lysaker, Stanley Osher, Xue-Cheng Tai, Noise Removal Using Smoothed Normals and Surface Fitting, January 2003. IEEE Transection on image processing, vol. 13, no. 10, oct. 2004, pp. 1345-1457.**

**9. Xue-Cheng Tai and Tony F. Chan, A survey on Multiple Level Set Methods with Applications for Identifying Piecewise Constant Functions, International J. Numer. Anal. Modelling, vol. 1, no.1, pp. 25-48, 2004.**

**欢迎大家参加!**