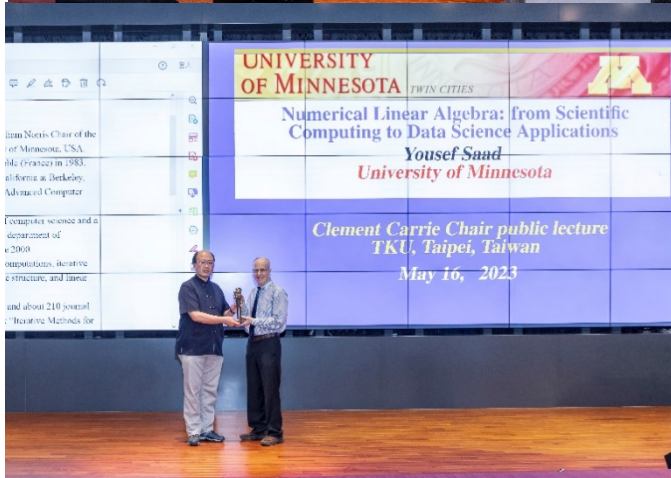
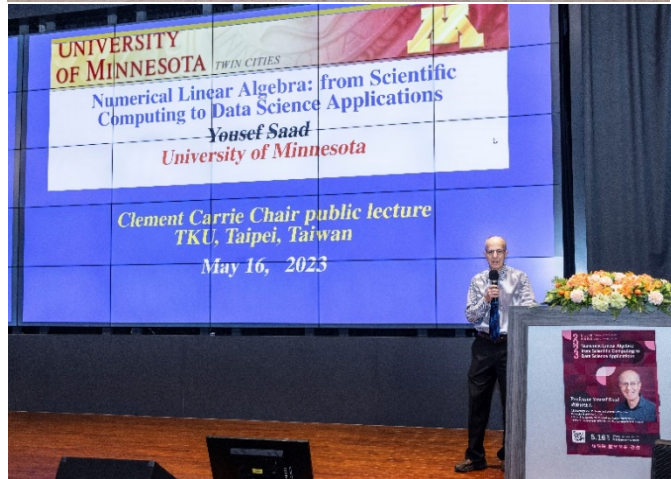


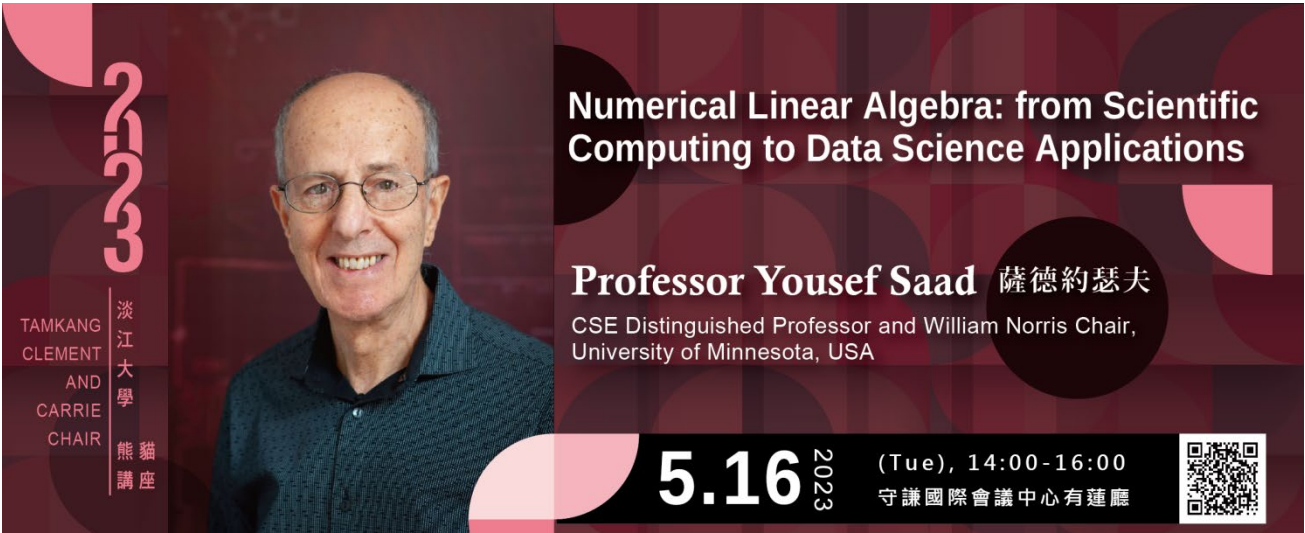
# LECTURE 18



## **Dr. Yousef Saad**

- **College of Science and Engineering (CSE) Distinguished Professor, University of Minnesota, 2005**
- **William Norris Chair, Department of Computer Science and Engineering, University of Minnesota, 2006-present**
- **Fellow of the Society for Industrial and Applied Mathematics (SIAM), 2010**
- **Fellow of the American Association for the Advancement of Science (AAAS), 2011**
- **SIAM John von Neumann Prize, 2023**

**Date: 2023.05.16**




The poster features a portrait of Professor Yousef Saad on the left. The background is dark red with abstract circular patterns. Text on the left side includes the year '2023' vertically, and 'TAMKANG CLEMENT AND CARRIE CHAIR' and '淡江大學 熊貓講座' (Tamkang University Panda Lecture Series). The main title is 'Numerical Linear Algebra: from Scientific Computing to Data Science Applications'. Below it, the speaker's name 'Professor Yousef Saad' is followed by his Chinese name '薩德約瑟夫' and his affiliation: 'CSE Distinguished Professor and William Norris Chair, University of Minnesota, USA'. The date '5.16 2023' and time '(Tue), 14:00-16:00' are displayed, along with the location '守謙國際會議中心有蓮廳'. A QR code is located in the bottom right corner.

2023  
TAMKANG CLEMENT AND CARRIE CHAIR  
淡江大學 熊貓講座

**Numerical Linear Algebra: from Scientific Computing to Data Science Applications**

**Professor Yousef Saad** 薩德約瑟夫  
CSE Distinguished Professor and William Norris Chair,  
University of Minnesota, USA

**5.16** 2023 (Tue), 14:00-16:00  
守謙國際會議中心有蓮廳



## INTRODUCTION

- Professor Yousef Saad, the Department of Computer Science and Engineering, University of Minnesota, USA, is one of the world leading experts on *Iterative methods for solving large sparse linear systems and eigenvalue problems*; *Sparse matrix computations*; *Parallel algorithms in numerical linear algebra*; *Numerical algorithms for materials science*; and *Matrix methods for information sciences*.
- He is a CSE Distinguished Professor of the University of Minnesota in 2005, the William Norris Chair of the University of Minnesota, since 2006, SIAM (*Society for Industrial and Applied Mathematics*) Fellow class of 2010, a Fellow of the AAAS (*American Association for the Advancement of Science*), 2011, and the 2023 recipient of the SIAM John von Neumann Prize.
- He has published 7 books, 61 Refereed Conference Proceedings and about 210 journal papers with more than 12,700 citations. In particular, his book “*Iterative Methods for Sparse Linear Systems*” published by SIAM in 2003 is highly cited of more than 2,650 times. He has been invited to many international conferences as plenary speakers (about 40 times from 2012).
- He has served as associated editors of journals: SIAM Journal on Numerical Analysis, IEEE Journal on Parallel and Distributed Computing, Computer Physics Communications, and SIAM Journal on Matrix Analysis. He is now an Associated Editor of journals: Electronic Transactions of Numerical Analysis (since 2001), Journal of Numerical Linear Algebra with Applications (since 1992).

## Topic : Numerical Linear Algebra: from Scientific Computing to Data Science Applications

### **ABSTRACT**

Numerical linear algebra is at the core of virtually every field of science and engineering, whether in solving linear systems that arise from simulations of physical phenomena, or in obtaining various solutions of optimization problems in data related applications. As the world around us is progressively being analyzed or modeled with the help of available data, the types of computational problems encountered are changing, and as a result the field is currently undergoing a deep transformation. This lecture will present an overview of the methodologies used in both the scientific computing and the data science disciplines, with an emphasis on what distinguishes these two worlds. We will examine in some detail the idea of '*dimension reduction*', a common tool that is exploited in solving data mining and machine learning problems. Dimension reduction is based on the precept that the observed data often lies in a noisy version of a low-dimensional subspace and so it is critical to work in this subspace not only to reduce computational cost but also to improve accuracy. At the core of dimension reduction methods are low-rank approximation techniques which are also quite common in various applications in science and engineering. One of the difficulties encountered in this class of methods is to find the inherent approximate rank of the data at hand. We will show how a few simple random sampling methods for computing spectral densities and counting eigenvalues can be used for this purpose. Among other topics, the talk will also cover applications of graph Laplacians, such as clustering and image segmentation, as well as methods for analyzing networks. It will also illustrate how the idea of graph coarsening has been developed independently by data scientists and numerical analysts. Finally, in an era where Deep Learning is becoming omnipresent, it is essential to discuss how this trend is impacting numerical methods in general, starting with the change in the kinds of mathematical analysis tools employed to the change of software and programming languages used. As an example, we will see how nonlinear acceleration methods developed mainly for scientific computing have been adapted for accelerating optimization algorithms in neural networks.

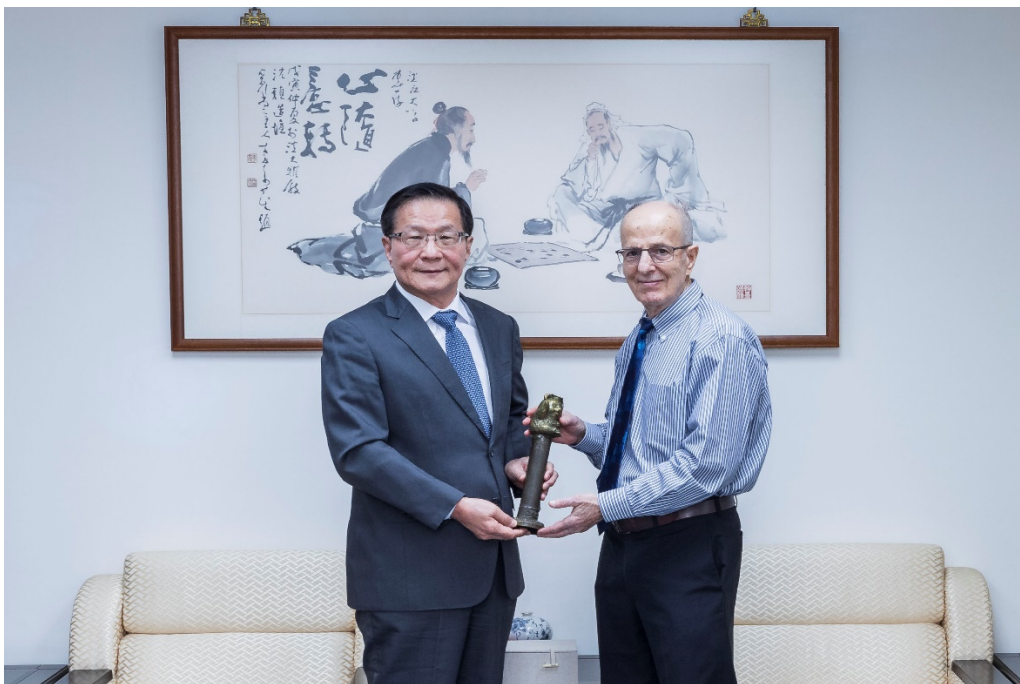


**MINUTE**





**Meet with the Chairperson of the Board, Dr. Flora Chia-I Chang**







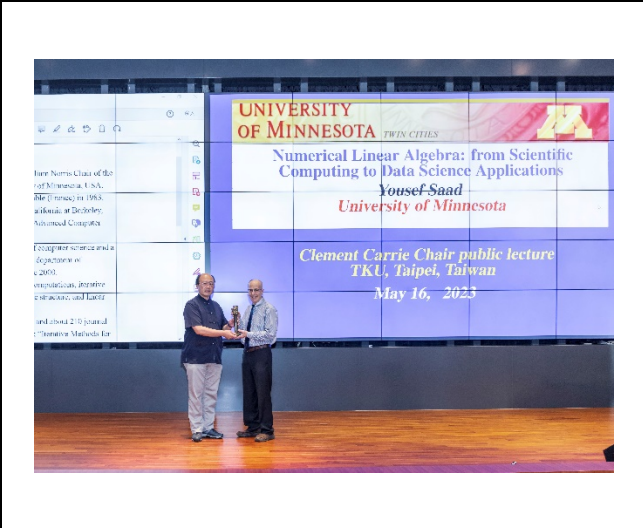
**Meet with the President of Tamkang University, Dr. Huan-Chao Keh**

**Dr. Zhang Jianbang of Tamkang University and Mrs. Zhang Jiangwenqi's Panda Lectures were delivered at the International Conference Center**

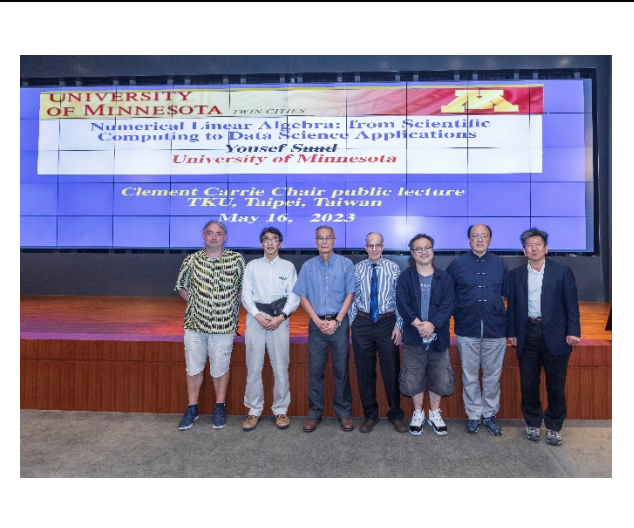
- **Professor Yousef Saad visited Tamkang University during May 14-21, 2023. Prof. Jong-Sheng Guo at the Department of Mathematics of TKU made receptions and accompanied him during his stay at Hwei-wen Hall. His visit was honored by Tamkang Clement and Carrie Chair Lecture Fund in Taiwan.**
- **After the lecture at TKU, Professor Yousef Saad visited the President of TKU Huan-Chao Keh and the chair of the Board, Dr. Jiayi Zhang. Professor Yousef Saad also visited the Tamsui campus of Tamkang University and was deeply impressed by the beautiful campus.**

- Professor Yousef Saad delivered a two-hour Chair Lecture on Numerical Linear Algebra at the international conference center on May 16, 2023. There were many faculty and hundreds of students from the Department of Mathematics attending the lecture. When delivering his speech, Professor Yousef Saad received great attentions from the audience and interacting with the audience during the Q&A session

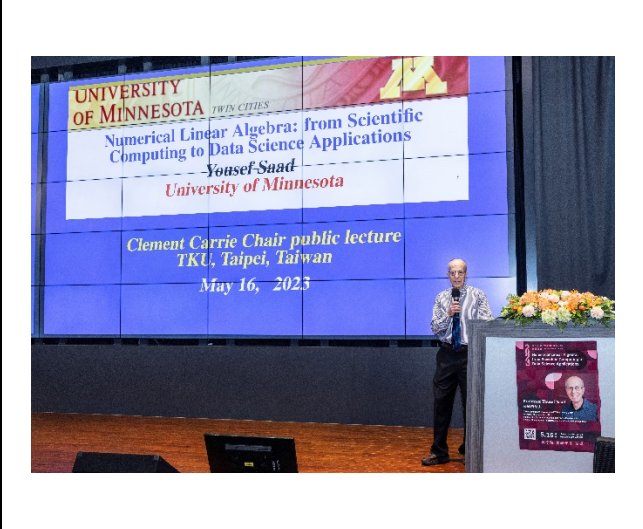
**activity photos**



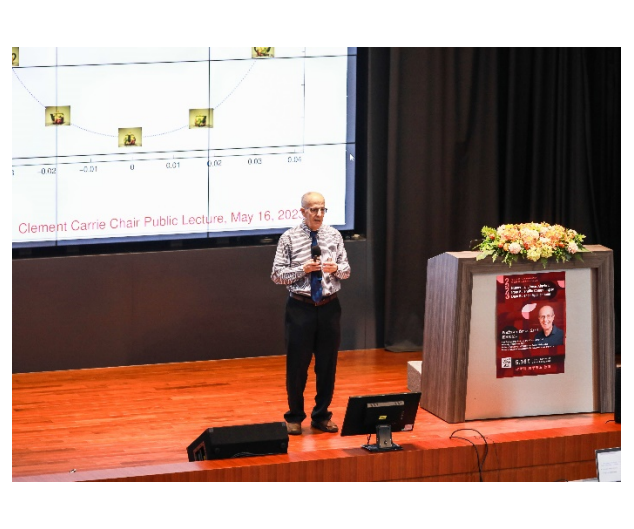
**Dean of the Faculty of Science, Dr. Tzeng-Lien Shih, presented a bronze panda trophy to Professor Yousef Saad**



**Photo with Dean of Science College, Dr. Tzeng-Lien Shih, Prof. Arnaud Ducrot (Normandie University, France), Ken-Ichi Nakamura (Meiji University, Japan) and Mathematics Faculty**



**speech scene**



**speech scene**





**Participating teachers and students focus on listening**



**Participating teachers and students focus on listening**