

大會議程

5 月 6 日 (六)		
時間	議程	說明
09:00-09:30	報到	
09:30-10:00	開幕	
10:00-11:00	大會演講 (Maria J. Esteban)	60 分鐘
11:00-11:30	學生論文簡報 1 分鐘快講	
11:30-11:50	大合照	
12:00-12:30	TWSIAM 會員大會	
12:30-13:30	午餐時間/壁報論文	思渤科技股份有限公司說明會 (綜合院館 270308 教室)
13:30 15:10	A 迷你論壇	100 分鐘 (一個邀請演講及三個小演講)
15:10-15:40	茶會	
15:40 17:40	工業論壇/人才交流會 (Job Fair)	60 分鐘/60 分鐘 工業與數學大會主講：張榮語董事長 人才交流會 (Job Fair): 陳建宏董事長、 陳鴻源副總
17:40-18:00	交通接駁	
18:00-19:30	晚宴	
19:30-	深坑老街	自由參加 (視天候狀況而定)

5 月 7 日 (日)		
時間	議程	說明
06:00-07:00	mini tour 環山道健行	自由參加 (視天候狀況而定)
08:30-09:00	報到	
09:00-10:00	大會演講 (Raymond Hon-Fu Chan)	60 分鐘
10:00-10:20	茶會	
10:20-12:00	B 迷你論壇	100 分鐘 (一個邀請演講及三個小演講)
12:00-12:50	午餐時間/壁報論文	思渤科技股份有限公司說明會 (綜合院館 270308 教室)
12:50-14:30	C 迷你論壇	100 分鐘 (一個邀請演講及三個小演講)
14:30-14:50	茶會	
14:50 15:50	數學建模教育論壇	60 分鐘 (郭鴻基教務長、 賴以威教授)
15:50 16:30	閉幕與頒獎	

大會論壇

工業論壇	
時間	2017.5.6(六) 15:40-16:40
地點	政治大學綜合院館 3 樓演講廳
主持人	陳宜良教授（國立臺灣大學數學系）
主講人	張榮語董事長（科盛科技股份有限公司）

人才交流會 (Job Fair)	
時間	2017.5.6(六) 16:40-17:40
地點	政治大學綜合院館 3 樓演講廳
主持人	王偉仲教授（國立臺灣大學數學系）
與談人	陳建宏董事長（臺灣動藥國際股份有限公司）
與談人	陳鴻源副總（華源磁振科技股份有限公司）

數學建模教育論壇	
時間	2017.5.7(日) 14:50-15:50
地點	政治大學綜合院館 3 樓演講廳
主持人	舒宇宸教授（國立成功大學數學系）
與談人	郭鴻基教務長（國立臺灣大學大氣科學系）
與談人	賴以威教授（國立臺灣師範大學電機工程學系）

迷你論壇

A 迷你論壇 5 月 6 日 (六) 13:30-15:10

Section 1		
Climate and Mathematics (主持人: 王寶貫主任)		
地點: 綜合院館 270302 教室		
時間	講者	主題
13:30-14:10	許晃雄	Development and Implementation of a Global-to-Urban Climate Model Suite
14:10-14:30	王寶貫	Simulating Free Fall Motions of Ice Hydrometeors in Clouds
14:30-14:50	李威良	Quantifying the Impact of Topography on Surface Solar Radiation for Applications to Weather and Climate Models
14:50-15:10	周昆炫	The Influence of the Tropical Cyclone Size on the Wind and Rainfall during Landfall
Section 2		
Applied Optimization (主持人: 陳鵬文教授)		
地點: 綜合院館 270303 教室		
時間	講者	主題
13:30-14:10	陳素雲	Statistical Properties for Multilinear Principal Component Analysis with Applications to Image Data
14:10-14:30	陳定立	DimensionSelection for Two-Step Linear Discriminant Analysis
14:30-14:50	柯春旭	Guidance and Obstacle Avoidance of Robot Walking Helper by Using Optimization Method
14:50-15:10	劉聚仁	The Application of Hidden Markov Models in Sleep Stage Assessment
Section 3		
Numerical PDE (主持人: 楊肅煜教授)		
地點: 綜合院館 270304 教室		
時間	講者	主題
13:30-14:10	施因澤	Tailored Finite Point Method for Solving Partial Differential Equations
14:10-14:30	朱家杰	Volumetric Variational Problems for Partial Differential Equations on Manifolds
14:30-14:50	胡馨云	The Role of Quadrature in Meshfree Methods
14:50-15:10	謝博文	IAS Difference Scheme for an MHD Duct Flow Problem

Section 4		
Machine Learning (主持人: 李育杰教授)		
地點: 綜合院館 270305 教室		
時間	講者	主題
13:30-14:10	廖弘源	深度學習於演唱會視訊雜湊
14:10-14:30	陳煥宗	Learning to Recognize Chess Pieces
14:30-14:50	王鈺強	Deep Transfer Learning for Visual Classification and Beyond
14:50-15:10	蔡銘峰	Textual Data Analytics in Finance
Section 5		
Mathematical Modeling and Laboratory Experiments on Water Waves(主持人: 袁淵明教授, 林呈教授)		
地點: 綜合院館 270306 教室		
時間	講者	主題
13:30-14:10	Henrik Kalisch	Wave Breaking in Undular Bores
14:10-14:30	許弘莒	Exact Nonlinear Internal Azimuthal Waves in the Rotational Stratified Fluids
14:30-14:50	黃薇穎	Characteristics of Vortex Structure from Separated Boundary Layer during Run-down Motion of Solitary Wave Propagating over Very Steep Beach
14:50-15:10	林呈	Laboratory Experiment of Breaking Wave
	吳昀達	Impact on a Horizontal Deck

B 迷你論壇 5 月 7 日 (日) 10:20-12:00

Section 1		
航太科技中的計算數學與應用 (主持人: 吳宗信教授)		
地點: 綜合院館 270302 教室		
時間	講者	主題
10:20-10:45	吳岸明	Multi-Segment Compact Finite-Difference Method for Interplanetary Orbit Design
10:45-11:10	劉小菁	Image Data Co-registration and Fusion Technique in Time Series Data Application
11:10-11:35	翁瑞麟	General Dynamical Equations of Motion in Elastic Body Systems
11:35-12:00	王璿豪	A Full-Space Quasi Lagrange-Newton-Krylov Algorithm for Trajectory Optimization Problems
Section 2		
Numerical Linear Algebra: Matrix Tensor and Applications (主持人: 王辰樹教授)		
地點: 綜合院館 270303 教室		
時間	講者	主題
10:20-11:00	郭岳承	Continuation Methods for Computing Z-/H-eigenpairs of Nonnegative Tensors
11:00-11:20	范洪源	Numerical Methods for Solving Linear Systems with Tensor Product Structures
11:20-11:40	劉青松	Newton–Noda Iteration for Finding the Perron Pair of An Irreducible Nonnegative Tensor and Its Applications
11:40-12:00	翁章譯	Perturbation Analysis of Rational Riccati Equations
Section 3		
數理經濟 (主持人: 曾正男教授)		
地點: 綜合院館 270304 教室		
時間	講者	主題
10:20-11:00	王信實	A New Economic Approach of Advertising
11:00-11:20	彭喜樞	The Role of Diminishing Marginal Utility in the Ordinal and Cardinal Utility Theories
11:20-11:40	張聖賢	Interactive Analysis and Prediction of Open Interest in Futures Market and TAIEX
11:40-12:00	洪芷漪	Option Pricing by Branching Processes

Section 4		
Optimization (主持人: 陳政輝教授)		
地點: 綜合院館 270305 教室		
時間	講者	主題
10:20-11:00	陳界山	Numerical Comparisons Based on Four Smoothing Functions for Absolute Value Equation
11:00-11:20	林義貴	System Reliability Maximization for Stochastic Flow Networks
11:20-11:40	洪一薰	The Variational Inequality Approach to Investigate the Effect of Subsidies on Reverse Supply Chains
11:40-12:00	陳政輝	Mathematics and Optimization in Disease Treatments: Examples in HIV Infection and Cancer
Section 5		
Contributed section (主持人: 曾睿彬教授)		
地點: 綜合院館 270306 教室		
時間	講者	主題
10:20-10:45	曾睿彬	Multistability in Neural Networks with Delays
10:45-11:10	何友達	Segmentation of Brain Tumour from A Pair of Magnetic Resonance Images using Scattergram
11:10-11:35	林澤佑	Feature Portfolio Construction with Deep Learning

C 迷你論壇 5 月 7 日 (日) 12:50-14:30

Section 1		
Data Science (主持人: 盧鴻興教授)		
地點: 綜合院館 270302 教室		
時間	講者	主題
12:50-13:30	銀慶剛	A High-Dimensional Location-Dispersion Model with Dependent Error and Its Applications to WTA Data Analysis
13:30-13:50	劉聚仁	Assess Sleep Stage via Multitapered Synchrosqueezed Transform
13:50-14:10	林祐霆	When Manifold Learning Meets Human Circulation System
14:10-14:30	黃韋強	Capture Some Smallest Eigenvalues and Corresponding Eigenvectors of the Graph Laplacian Matrix
Section 2		
流構耦合 (主持人: 洪子倫教授)		
地點: 綜合院館 270303 教室		
時間	講者	主題
12:50-13:15	陳明志	A DFIB-SPH Model for Simulations of Fluid-Structure Interaction
13:15-13:40	曾昱豪	An Immersed Boundary Method for Endocytosis
13:40-14:05	王建凱	Finite Element Analysis of Fluid-Structure Interaction for Solids Undergoing Finite Deformations
14:05-14:30	游承書	A Two-Stage Direct-Forcing Immersed Boundary Projection Method for Fluid-Solid Interaction Problems
Section 3		
多相流 (主持人: 楊馥菱教授)		
地點: 綜合院館 270304 教室		
時間	講者	主題
12:50-13:30	周逸儒	Particle-Induced Flow Instabilities and Convection in Natural Environment: A Numerical Study
13:30-13:50	陳彥龍	Characteristics of Abnormal Polymer Transport in Crowded Environments
13:50-14:10	曾建洲	Numerical Simulation for a Flue Gas Desulfurization Tower
14:10-14:30	李庚霖	Relaxation-Type Non-local Constitutive Model for Dry Granular Flow

Section 4		
學生社群分享 (主持人: 蔡炎龍教授)		
地點: 綜合院館 270305 教室		
時間	講者	主題
12:50 -13:15	成澤仕軒	交通大學學生社群分享
13:15-13:40	李昱勳	成功大學學生社群分享
13:40-14:05	邱匯吟	中央大學學生社群分享
14:05-14:30	陳先灝	政治大學學生社群分享

2017 第五屆台灣工業與應用數學年會

學生海報論文競賽 一分鐘快講

(博士組)

編號	作者	題目	摘要
D1	樂美亨	An Efficient Energy Minimization for Conformal Parameterizations	Surface parameterizations have been widely applied to digital geometry processing. In this paper, we propose an efficient conformal energy minimization (CEM) algorithm for computing conformal parameterizations of simply-connected open surfaces with a very small angular distortion and a highly improved computational efficiency. In addition, we generalize the proposed CEM algorithm to computing conformal parameterizations of multiply-connected surfaces. Furthermore, we prove the existence of a nontrivial accumulation point of the proposed CEM algorithm under some mild conditions. Numerical results indicate that the CEM algorithm outperforms other state-of-the-art algorithms.
D2	蘇建嘉	Skew Freeform Reflectors for Two-Dimensional Illuminance	We propose a three-dimensional (3D) freeform surface design method. The freeform surface is constructed by using the two-dimensional (2D) skew freeform model and quadratic surfaces fitting without optimization process. First, the global light source domain and illuminant target domain, denoted by Ω_p and Ω_c respectively, are partitioned into numerous subdomains Ω_p^i and Ω_c^i , $i = 1 \cdots n$, satisfying local energy conservation. Next, a 2D skew freeform is constructed by solving a series of nonlinear ordinary differential equations (ODEs) resulting from 2D non-coplanar freeform design where the source and target illuminance distribution are computed to represent the energy distribution in each of the corresponding subdomain pairs. Finally, for 3D freeform design, instead of solving the complicated Monge-Ampère (MA) equation directly, our 3D freeform surface is constructed by fitting quadratic surface on a 3D skeletal frame consisting of the 2D skew freeform curves.
D3	林正釗	Computational Granular Flow with a Regularized Visco-Plastic $\mu(I)$ Constitutive Relation	A generic continuum rheology model for dense granular flows has been widely investigated by many researchers via theoretical analysis, particle-based simulations or experiments. Among existing models, a phenomenological $\mu(I)$ rheology relation has been widely adopted as it is supported by dimensional analysis and validated via experiments in different flow configurations. Due to its complex formulation, an analytic solution is impossible for general flow configurations and hence a numerical solution is desired. We develop a finite-volume Non-Newtonian flow solver using the Pressure-Implicit-Splitting-Operator (PISO) method for this visco-plastic flow. The singularity embedded in $\mu(I)$ upon the onset of bulk motion is handled by a simple regularization technique. The flow solver was tested on two-dimensional plane shear flows and flows in avalanche down an inclined plane over a wide range of flow conditions, returning perfect agreement to the analytical solutions.

2017 第五屆台灣工業與應用數學年會

學生海報論文競賽 一分鐘快講

(碩士組)

編號	作者	題目	摘要
M1	林伯儒	An optimal control of a dengue model with changing proportion of patients hospitalized	世界衛生組織在第三版 (2009) 的登革臨床指引，導入警示徵象 (warning signs) 與嚴重度分級 (severity-based) 的概念，於是我們提出分級分流 (SIABCR/SEI) 的新模型。也得到模型的感染基數 (R_0)，並分析了 Disease Free Equilibrium 的穩定性。更進一步使用最佳化控制來研究各種防疫策略的花費與成效，並發現不同參數和權重下產生的不同影響。
M2	顏瑋郁	Optimal assessments of the strategies for central controllers	Global warming and the vigorous development of electric vehicles have rendered the effective deployment of charging stations crucial in the promotion of electric vehicles. In this study, Simulation of Urban Mobility (SUMO) was employed to simulate electric vehicle charging in the North District of Taichung City, Taiwan to collect data on the use statuses of electric vehicles and the occupancy rate of charging stations. Subsequently, game theory was adopted to analyze electric vehicle paths, devise the optimal strategy for selecting charging stations, and predict the paths that would be taken by electric vehicles in the future. Additionally, the congestion situations of the charging stations were assessed and the time cost prediction formula obtained from study was revised to enable assessments of the possible locations where charging stations could be placed.
M3	廖子華	BluePrint	The concept of curriculum mapping has put into practice in most universities. By combining it with graph theory, we found connections between different lectures. Therefore, we designed a system which may benefit students from learning. This system also provides curriculums searching and courses recommendation based on the interested fields and expertise of the students. We named it as BluePrint.
M4	林芷卉	高階馬可夫鏈在交通流上的應用	隨著社會經濟和交通事業的發展，交通擁擠的問題越來越顯現出來，為了提早避開塞車時段，因此旅行時間的計算扮演著不可或缺的角色。針對此議題，我們需要建構出一個時間與路段的平均車速間的預測模型，以馬可夫鏈模型來進行預估，盼能最小化其預測誤差。高階馬可夫鏈是一種隨機過程預測方法，藉由過去一段期間系統所呈現的狀態，推測未來系統各期的狀態以及發生的可能性。之後再利用建構好的馬可夫鏈模型去解決張量特徵值問題。若運用到交通上，可以藉由資料的收集，進而推測長期交通情形。本研究以實際的交通狀況為例，先把大量的交通數據經過一連串的分析，利用分析後的數據構造出高階馬可夫鏈，一般的馬可夫鏈矩陣只能描述與上一步的狀態變化關係，但是交通狀況可能更之前就有預兆了，我們想要更為精準地去預測交通狀況，因此我們利用高階馬可夫鏈來表現其複雜關係，我們比較不同階層的馬可夫鏈並給出一些數值結果並比較其預測能力。
M5	林冠宇	Reprove Perron-Frobenius Theorem by the Homotopy Continuation Method	The result of Perron-Frobenius theorem is elegant, but the proof is too complicated and can not be understood directly. This poster gives an elementary proof of Perron-Frobenius theorem by the homotopy continuation method.

編號	作者	題目	摘要
M6	楊佳晉	Thin-Wire Model for FD-TD method	The telegrapher's equations are a pair of coupled, linear differential equations that describe the voltage and current on an electrical transmission line with distance and time. An important application of telegrapher's equations is to model antennas. The current moving in the wire interacts with the electric field. The magnetic field couples with electric field through Maxwell's equations. Here we introduce the Finite-Difference Time-Domain (FD-TD) method, a numerical method for solving the Maxwell equations. We also propose a new method for solving the telegrapher's equations on a narrow band region surrounding the thin wire. The computation grid are the equidistant Euclidean grid. Therefore it is very easy to implement. We will explain how to couple the telegrapher's equations with the Maxwell's equations in Cartesian grids.
M7	李昱勳	Mathematical Modeling and Computational Issues of Dengue Epidemics	Dengue, an infectious tropical disease, has recently emerged as one of the most important Mosquito-borne viral diseases in the world. In 2015, Tainan has experienced severe dengue epidemics. According the open data from Tainan City Government, we found some interesting issues. We use Susceptible-Exposed-Infected-Recovered model (SEIR model) and a smooth effective contact rate to simulate the spread of Dengue Epidemics. The effective contact rate and basic reproduction number decays after the epidemic prevention works by the government. We perform a Monte Carlo simulation to estimate temporal prevalence of asymptomatic dengue viremia (ADV) among people aged 20 – 64. A very high prevalence of asymptomatic dengue viremia was found in Tainan.
M8	蔡函儒	Statistical Learning Method for training Linear Programming Machine by data	A statistical learning problem is to minimize the loss function between the true response and the output provided by the learning machine under a particular hypothesis set. However past studies haven't taken decision maker preference structure into account. Therefore we develop a Linear programming machine (LP machine) based on linear programming coefficient assumption hypothesis set. Our study is aimed to find out some interesting property of LP machine such as minimum requirement on the sample size and complexity of model .
M9	許心芸	平行化二邊逐次修正法	派車問題又稱為車輛途程問題 (Vehicle Routing Problem)，它是指一定數量的客戶，進行車隊分配與路程規劃。將資料點以 k-mean 分群為基礎，搜尋每個群體的數量平均的最佳解。路程規劃為一旅行推銷員問題 (Travelling Salesman Problem,TSP)，利用對角線完全算法生成一條漢彌爾頓路徑，再用平行化的二邊逐次修正法以及 Feiring 逐次修正法得到一條最短路徑的近似解。
M10	黃筱涵	Solving the Bethe-Salpeter Eigenvalue Problem by Using Structure-preserving ΓQR Algorithm	In our lives, there are many problems can be transformed into a Bethe-Salpeter equation, this equation can be still transformed into a Bethe-Salpeter eigenvalue problem after discretizing. In order to solve the Bethe-Salpeter eigenvalue problem which is a matrix with a special structure. We find the Gamma-QR algorithm to calculate the eigenvalues and ensure that each step in the calculation preserves its structure at the same time. Also accelerate the speed of convergence by adding some technology. Finally, we show some numerical experiments to explain the good effect of the Gamma-QR algorithm.

編號	作者	題目	摘要
M11	劉馥榮	Linearization or not. A Numerical Study of Two Solution Algorithms for Quadratic PDE Eigenvalue Problems	We numerically investigate the numerical performance of two solution algorithms for the quadratic eigenvalue problems (QEPs), namely the linearization approach and the polynomial Jacobi-Davidson method. Such eigenvalue computations play an important role and highly-demanded in many computational sciences and engineering applications, such as the noise control in the acoustical design, stability analysis in the structural engineering, and electronic engineering. In the linearization approach, the QEP is linearized as a companion generalized eigenvalue problems (GEVPs) and then a variety of linear eigensolvers are solved the resulting GEVPs. On the other hand, the polynomial Jacobi-Davidson method targets the eigenvalue of interests directly without any transformation. The evaluation metrics are the robustness, accuracy, and efficiency. To draw the conclusion for more general situations, we conduct intensive numerical experiments for a large number of test cases generated by the NLEVP, a collection of nonlinear eigenvalue problems, with a various problem size and different coefficient matrices properties.
M12	蔡普丞	Numerical Algorithms in 3-D restructure	3D 列印技術經過 20 多年的發展和進化，已成為現代製造流程不可或缺的重要輔助技術，具備高度客製化和快速生產的優勢，協助產業生產高精度的產品原型供研發部門進行相關測試和評估，縮短產品開發流程，降低最終大量生產成本。在這篇論文中，我們希望藉由數張拍攝同一物體的相片，來還原原物體的真實位置。還原的過程中，我們把問題分成兩部分。一、在數張相片上找到各個對應點，二、在已知對應點的情況下還原物體在三維的座標。在問題一裡，我們應用 Simplex method 找點對應，在問題二裡，我們使用 Alternating Projection Algorithms 還原物體位置樣貌。
M13	蔡秉軒	Green-function-like pseudo spectral solution operator for Poisson equation	In this study we present a multidomain Legendre pseudospectral penalty scheme for Poisson problems defined on general domains. We pay special attention upon constructing the discrete Laplace operator to possess certain matrix properties, so that the existence of the inverse of the pseudospectral penalty Laplace operator can be established. Furthermore, it is found that there are correspondences between the present numerical formulation and the analytic Green function approach. Numerical experiments are conducted and we observe exponential convergence of the approximation solutions as expected.
M14	蔡欣翰	A Scalable and Ultrafast Eigensolver for Three Dimensional Photonic Crystals on GPU	This research applies parallel computations on a GPU by CUDA for solving three dimensional Maxwell's equation with face-centered cubic (FCC) lattice. We focus on how to solve an Eigenvalue Problem more efficiently. Because of the problem we solved is Hermitian and positive definite. The algorithm of the solver is based on inverse Lanczos method for eigenvalue problems and associated conjugate gradient method for linear systems. By using cuBLAS, cuFFT, combining kernels, transpose multiple matrices simultaneously, and some skills, we can save time from computations or accessing memory. Integrating all techniques, we can solve each of a set of 5.184 million dimension eigenvalue problem for 10 smallest positive eigenvalues within 44 to 63 seconds. And we have a great scalability on multiple GPU cards by MPI. All results are computed on two clusters. One is equipped two GPU cards called NVIDIA Tesla K40c, most of works are computed here. And the other is equipped a lot of GPU cards called M2070, which are used for MPI.

編號	作者	題目	摘要
M15	蘇郁舜	The alternating direction method of multipliers on dimension reduction and parameters selection	氣喘在現今醫學上是一種常見的支氣管慢性炎症性疾病，一般認為是由基因和環境因素影響所共同導致的。儘管氣喘是世界一種公認的疾病，但對於氣喘的定義目前還沒有一致認同。期望能透過降維的方法，找到肺部型變的潛在氣喘資訊而較明確的定義及區分氣喘與否。降維的方法主要分為線性與非線性，最常用的線性降維方法為 Principal Component Analysis (PCA)，而有效的非線性降維法為 Locally Linear Embedding (LLE) 及 Maximum Variance Unfolding (MVU) 等。而這些方法都是透過找出資料的右奇異向量 (right-singular vectors)，並去除其中較不重要的右奇異向量以縮減維度。於此，我們提出以 ADM 為架構的降維方式，以幾何概念增加資料點的 Frobenius norm 來攤平資料，以達到降維的效果。
M16	呂治鴻	Boundary layer solutions of charge conserving Poisson-Boltzmann equations with variable dielectric coefficients	In this paper, I investigate the boundary layer solutions of the charge conserving Poisson-Boltzmann (CCPB) equations with variable dielectric coefficients for multiple species over a bounded connected domain with smooth boundary. Under Robin type boundary conditions with variable coefficients, the asymptotic limits (as $\varepsilon \rightarrow 0$) of solution values at interior and boundary points are uniquely determined by explicit nonlinear formula involving the boundary value of dielectric. Furthermore, I also study the asymptotic pointwise estimate which describes the boundary layer width is $O(\varepsilon)$.
M17	劉家植 黃國森 吳芷綺	運用數學方法分析抗原-抗體模型之反應常數值	反應速率常數之討論在化學領域一直以來都是個重要議題，不論是在理論或應用上都已有許多深入探討，本文主要討論由中正大學奈米生物檢測中心所開發的生醫檢測儀器，並探討其中的數學問題。
M18	劉鈞庭 賴馨怡	A 3D object construction algorithm arising from point cloud capturing	Use structure light to encode the spatial position, and do camera calibration and projector calibration to get the camera and projector intrinsic parameters and relative position. And use these information to reconstruct the 3D object point cloud. After we got the point cloud, we calculate the normal vector and reconstruction the surface.
M19	王璿豪	A full-space quasi Lagrange-Newton-Krylov algorithm for trajectory optimization problems	We will introduce the common mission of satellite vehicle and the application of trajectory optimization. This type of mission can be translated into the optimal control problems. To solve this problems, We propose the full-space quasi Lagrange-Newton-Krylov (QLNK) method. To improve the efficiency of computing, We compare three different approaches including finite difference, automatic differentiation and BFGS to form the Hessian matrix of the Lagrange function. Furthermore we use slack variable method to solve the inequality constraints. Finally, we will show our numerical results for optimization problem.
M20	陳彥禎	Parallel Computation on Genome-Wide Associated Studies	GWAS (Genome-Wide Associated Studies) is a very critical part of genomic studies. It aims to specify relations between genes and traits. There are billions of base pairs in human DNA, although scientists found that we can look at SNPs (single nucleotide polymorphisms) instead, there are still a lot of data to look at. Therefore, we introduce parallel computing on this problem to get higher efficiency. To find out whether a SNP is critical for a single trait, we simply do a linear regression on each SNP-trait pair. Although the method seems easy, the extreme number is a large barrier for this method to work. In our research, we want to find out how 653291 SNPs affect 55749 brain voxels. Which indicates that we have to do over 36 billion linear regressions. It takes more than 3 months to run by MATLAB. However, with our GPU code, we can finish all calculation in 14 hours without the loss of accuracy. With our fully parallelized code, we can expect even larger performance on multiple GPU systems. Genome analysis problems will no longer be limited by its massive amount.

編號	作者	題目	摘要
M21	蔡宇翔	A Highly Parallel GPU Solver for Large-scale Eigenvalue Problems for Classifying the Disordered Polymers	A solver for large sparse general eigenvalue problem in which area we really desire. It can solve the problem highly parallelly on many GPUs. It estimates the number of eigenvalue in the area based on Contour Integral method. It divides the area to small problems to make every interval be done in similar time and make each node have enough memory to solve it. Then, it solves eigenpairs in small problems by Block SS-RR method in parallel. We use the information of eigenpairs to classify the different relative rotation angles between adjacent benzene rings of different polymers.
M22	林宥樺	Time Series Unit Pattern Extraction and Classification	The Internet of Things (IoT) has been growing rapidly in recent years. In IoT scenario, time series data is recorded and transmitted continuously. Hence, it is important to handle time series problems, such as time series classification. In time series, it is critical to find the most significant features. With features selected, time series can represent into a set of characterized values. Most of the time series representation techniques are not completely interpretable. Therefore, a novel time series representation which is named 'envelope' was proposed. This supervised feature extraction method transforms time series into simple values with only 1/0/ - 1. Moreover, the characteristic of sparsity is essential property for applying compressed sensing. Finding the most significant features for data mining is an important task. Before applying envelope, this method has prerequisite that time series must be well-synchronized with same length. By using a peak-valley based method, unit patterns can be cut from time series quickly. First, finding all the peaks and valleys with threshold and comparison range. Second, label different kinds of extremums and combine the nearest labeled others together in a specific length as a subsequence. The length is calculated by difference of the most discriminating peaks' index. After voting for the most common combination in subsequence list, the unit pattern formation is ensured. As expected, unit patterns can be extracted from time series and rescaled appropriately to make envelope work well on time series data.
M23	顏祈文	The relation between Kepler orbit and initial velocity on the planar central configuration	On two dimensional C.C. system, using the configuration of the distance which be decided by Albouy-Chenciner equations, we determine the initial velocity can be expressed by a linear combination of two vectors. Further, we define one-body problem to find the virtual central mass such that the motion of each particle can be view as the Kepler motion with the virtual central mass. Final, using the "Time of Fly", we can determine the time with each position by numerical simulate.
M24	陳俊宏	Reducing Communication in Parallel Distributed Direct Method for Solving Large Sparse Linear System.	在科學與工程領域中，時常會面對如何求解大型稀疏線性方程式的問題。隨著問題的尺度越大，礙於記憶體的限制，要在單一電腦下做計算處理變得很困難。目前不論直接法或是迭代法，常見的處理方式是將問題做適當的排序，再利用舒爾補方法 (Schur Complement Method) 將問題分為數個彼此獨立的子系統以及舒爾補矩陣的子系統。前者彼此獨立不相依，因此問題能夠在分散式記憶體系統下平行處理。不幸的，計算舒爾補矩陣時若是沒有注意計算與資料儲存的方式，在分散式系統中很容易導致過多的資料溝通 (Communication) 導致平行效能過低。然而我們發現，其實只要適當的安排矩陣的儲存方式，就能夠有效降低實作中需要的資料溝通。

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學生海報論文競賽 一分鐘快講

(大學組)

編號	作者	題目	摘要
B1	鍾逢耘 林宸旭 林源青 蘇立群 周芳宇	用類神經網路學習手寫數字辨識	本論文探討如何藉由機器學習辨別中文數字與阿拉伯數字。鑒於近年來深度學習的興起，我們小組對此感到興趣，並研究此方面的知識。我們從基礎的類神經網路開始學習，在熟悉程式後，進一步想到讓電腦學習辨識「中文數字」。經收集樣本資料，最終做出可同時分辨中文數字與阿拉伯數字的機器學習系統。
B2	林君陽 王羿軒 曹靖民 蔡季剛 徐賢豪	Dual Information in Efficiency Analysis by Mathematical Programing	Since the original Data Envelopment Analysis (DEA) study was published by Charnes, Cooper, and Rhodes (CCR) [1978], related researches have been continuously growing in many fields. DEA becomes a popular tool to evaluate the efficiency of factories, companies, hospitals and etc.... While most applications focus on the primal linear program, they often ignore the potential power for improving efficiency by dual variables. In this presentation, dual variables are shown in an example to illustrate how an inefficiency unit can be improved for better performance.
B3	陳鎮鴻	Study Collisions of Iron Balls via Experiments and Theoretical Predictions	In this study we try to build a model to explain the collision of iron balls and then compare theoretical predictions with experimental data. From results, we find (i) the collision will be greatly affected by the friction coefficient (ii) the best friction coefficient of iron to iron is 0.2, which follows the real case. Therefore, we think our model can explain the collision of iron balls.
B4	湯維豪	颱風動態預測	台灣大約每年七、八月時，會有數個颱風形成，使得台灣受到強風、巨浪、暴雨、暴潮、洪水、土石流、焚風等的威脅。以至於造成各行業及許多設施的嚴重受損，甚至使民眾的生命財產遭受威脅。因此，如果能夠掌握颱風的動態，並且提供正確的預警，能使民眾提早作好準備，降低風災帶來的損失。由於台灣地處颱風必經之路，希望透過這個計劃來了解颱風移動的機制，並且估計出颱風路經的走向，來對颱風的移動有更深入認識。雖然這個數學模型僅考慮颱風在海面上的移動並沒有將地表摩擦力列入考慮，但這個研究可以讓我們初步了解颱風路徑移動的機制。
B5	林敬翔 何盛揚	程式的下棋演算法	2016 年 3 月由 google 團隊研發最強的圍棋程式 alphago 出現，擊敗了世界棋王李世石。上網查資料得知，其程式使用的是「蒙地卡羅演算法」。它是一個利用統計學的大數法則，對雙方可能下的棋步進行模擬，從而找出較高勝率的點的演算法。我們想以此方法為動機，實作一套讓電腦模擬棋局的演算法。我們將以自創的棋-「感染」作為研究對象。目標是寫一個程式教電腦下這種棋，並在不將整張樹狀圖展開的前提下(窮舉所有棋步)，盡可能找出棋局的最佳下法。測試辦法為，讓前後寫出幾個版本的 ai 互相對戰，勝率較好的則相信該演算法較佳。
B6	李岳翰 詹佳叡 呂學翰 吳瑞恒 徐文翊	關節炎的中醫用藥行為分析	研究關於中西醫對於關節炎的用藥異同。主要研究中藥用藥的方式，並以最常被使用的藥在中藥醫理中的效果，比較和西藥針對關節炎所開的藥方的效果，是否有些相同相異之處。

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B7	黃彥傑 陳凱 鄭嘉雯	Ubike 補給問題 及相關分析	藉由統計計算 Ubike 各站在何時應補給幾輛車，才能使無車可借或無車可還的狀況降低，同時也能節省補車及觀測所需耗費的人力資源，並觀察如何補給才能使兩者之間達到平衡(民怨及耗費人力達平衡)。紀錄每日特定時段中，車輛的租借情形，計算此段區間內，變化量的最大值及最小值，並可由此二值得到一區間，經長期統計後可得到一平均區間。將此區間做為此時段的預估值，及此時段開始時，應將車輛補至此區間，則能降低此區間發生無車可借或無車可還的狀況的機率。若觀察後，某區間有出現變化率過大的狀況，則應增加此時段的補車次數；相對的，若變化率過小，則應減少此時段的補車次數。變化率過大及過小的標準可藉由與利潤的關係做調整。此標準設定若寬鬆，補車次數會相對提高，補車成本也會提升；反之，成本會降低。利用 Dijkstra 及 Spanning Tree 的演算法，計算每一次補車時，各點之間最短路徑，並計算出建議路徑。最終，在長期統計下，可得到一建議的補車時班表，能在民怨及利潤之間達到平衡，並相較於現今 24 小時觀測及補車的方式，更為節省人力資源及成本。
B8	方宜晟 林澤佑 莊喻能	Hanzi Typeface Research with Conditional Generative Adversarial Network	漢字字型設計是個耗費極大人力與時間的工作。不管是點陣字或是向量字。一個品質良好的漢字字型往往需要耗時一至兩年，多位字型設計師才能完成。我們試圖以 Conditional Generative Adversarial Network 與 Autoencoder 的方式進行字型研究。期望能夠找到關於漢字字型全新的造字方式。
B9	陳先灝 林奕勳 吳柏寬 黃梓育 邢恒毅 范原豪	Style Transfer using DeepLearning	In fine art, humans are good at creating paintings in different styles. Computer scientists have tried different ways to approach this. According to the paper from Gatys et al.[1], we built a style-transfer model using DeepLearning. However, we find it sometimes comes out with an unsatisfying result, so we tried to get a better output through giving different parameters or adjusting the weights of the function.
B10	陳俊碩 徐乃威 楊宛芸	Numerical Approach to Realize Hele - Shaw Flow with Injection	In this project, we are going to use numerical method to verify that the speed of decay of the perturbations back to an expanding sphere is exponentially which has been studied in Cheng et al.[1]. The Hele Shaw flow can be described by Poisson equation with moving boundary. Due to the purpose of this study, we will focus on the behavior of the boundary of the region. It is natural to consider Boundary Element Method (BEM) to numerically solve Hele-Shaw flow. Also, in order to speed up the computation, we use parallel computing toolbox to accelerate.
B11	陳奕廷	An endemic SIR model and its stochastic version: a comparison.	數學建模是許多應用科學的核心內容，生物數學中的傳染疾病研究分析也不例外，SIR 模型為此領域中最著名且應用最廣的一個模型。現今的生物學家在疾病分析中，不僅是需要從模擬中了解疾病傳染或爆發的特性，更是希望能掌控其傳染情況，進而提出好的防治策略。因此，建立好的模型就變成是一件非常重要的任務。著名的 SIR Epidemic model 討論的是在短時間尺度下，傳染疾病中的三個分類族群 (1) 易受影響的 Susceptible(S)、(2) 有傳染性的 Infective(I)、(3) 復原的 Removed(R) 隨著時間人數的變化，在短時間內不考慮出生率和死亡率的影响，總人口數在此模型中維持不變。本研究計畫的範疇為 SIR Endemic model，其為限制在一個區域的傳染疾病，在考慮人口的出生率和死亡率之下，討論三個分類族群隨著時間人數的變化。