Society for Industrial and Applied Mathematics

Doctoral Academy
Academi Ddoethurol

SIAM-UKIE NATIONAL STUDENT CHAPTER CONFERENCE

13-14 JUNE 2024

ABACWS BUILDING, CARDIFF

Contents

About

2024 UK National SIAM Student Chapter Conference

The Cardiff SIAM-IMA Student Chapter is proud to host the SIAM UKIE National Student Chapter Conference in 2024. The conference is a two-day event on Thursday 13th and Friday 14th of June.

The two-day conference will include four invited talks, contributed talks by attendees, a poster session and a conference dinner. Invited speakers cover various mathematical backgrounds, and we are pleased to also have an industry speaker at the conference. The conference is open to all postgraduate research students across the UK and Ireland. There will be plenty of opportunities to network. Moreover, this offers a great chance to those attending to present their research, either through a poster or a contributed talk.

Cardiff University SIAM-IMA Student Chapter

The Cardiff University SIAM-IMA Student Chapter is formed by the Society for Industrial and Applied Mathematics and the Institute of Mathematics and its Applications and includes students and faculty members from across Cardiff University who are interested in mathematics or scientific computing and their real-world applications.

Founded in January 2013, we are the first SIAM-IMA student chapter to be established in Wales and are now one of the most active student chapters in the SIAM UKIE section. We organise various academic and social events for postgraduate students in Cardiff, including a weekly PGR seminar, social gatherings and networking opportunities, poster sessions and competitions.

Our objectives are consistent with the objectives of SIAM and IMA:

- To promote the application of mathematics and computational techniques to problems of interest in science and industry.
- To further fundamental research in applied mathematics and scientific computing leading to new methods and techniques useful to industry and science.
- To facilitate effective interactions between researchers and students from across the University and between University members and industry by creating a forum for the exchange of scientific ideas in an inspiring and supportive environment.

For more information about us, or to keep updated with our events and activities, please head to our website `siam-ima-cardiff.github.io`, follow us on X (@CardiffSIAM_IMA), or email us at siam-ima@cardiff.ac.uk.

Welcome to Cardiff. Croeso i Gaerdydd.

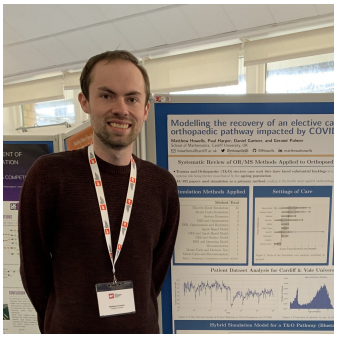
We encourage you to take the opportunity to enjoy the wonderful city of Cardiff, the capital of Wales, whilst you visit us. Compact, yet lively, Cardiff brims with rich culture and heritage, intertwining our deep Welsh roots with modern city life. A friendly and multicultural city, Cardiff is a welcoming and safe environment for people of all cultures, genders, and sexual identities.

Boasting a wide range of entertainment attractions and natural beauty, we have no doubt you'll find something to satisfy your interests here if you have the opportunity to do so. We recommend visiting one of the following websites as a starting point for visiting the city:

- Visit Cardiff (www.visitcardiff.com)
- Visit Wales - Cardiff (www.visitwales.com/destinations/south-wales/cardiff)
- Public Transport (www.cardiff.gov.uk/ENG/resident/Parking-roads-and-travel/Public-transport/Pages/Public-transport.aspx)

Organising committee

Michela Corradini



Matthew Howells

Anastasiia Kovtun

Prachi Sahjwani

Dr. Elizabeth Williams

Prof. Angela Mihai

Timetable

All talks will take place in room **2.26**. Coffee breaks, lunches and the poster session will take place in room **5.05**.

CT: Contributed Talk, PS: Plenary Speaker.

Thursday, 13th of June

09:00–9:45	**Registration**		
9:45–10:00	**Welcome remarks**		
10:00–11:00	PS	**Prof. Igor Podlubny** Technical University of Kosice	Fractional-order calculus in one hour: ideas, methods, and tools
11:00–11:30	**Coffee break**		
11:30–11:50	CT	**Disha Hegde** University of Southampton	Learning to Solve Related Linear Systems
11:50–12:10	CT	**Charlie Marshall** Cardiff University	Mathematical Programming for Scheduling Telemedicine Appointments
12:10–12:30	CT	**Ibrahim Mohammed** University of Strathclyde	The combined effects of heterogeneous susceptibility and non-pharmaceutical interventions on epidemic trajectories
12:30–13:30	**Lunch**		
13:30–14:30	PS	**Prof. Claudia Garetto** Queen Mary University of London	C^∞ well-posedness of higher order hyperbolic equations with multiplicities
14:30–14:50	CT	**Javier Chico Vazquez** University of Oxford	The Mathematics of Balance
14:50–15:10	CT	**Ghada Shuker Jameel** Cardiff University	Eigenvalue Bounds for Perturbed Periodic Dirac Operators
15:10–15:30	CT	**Rhys James** Cardiff University	Continuum modelling of particulate flows
15:30–17:00	**Poster session with Coffee & cakes**		
18:30	**Conference Dinner**		

Friday, 14th of June

09:00–10:00	PS	**Dr. Isaac Chenchiah** University of Bristol	Morphing Triangular Frameworks
10:00–10:20	CT	**Fan Wu** Cardiff University	Analysing Network Dynamics: The contagion effects of SVB collapse on the US Tech Industry
10:20–10:40	CT	**Hrit Roy** University of Edinburgh	On the L^p convergence of Fourier summation methods
10:40–11:00	CT	**Daniel Hambly** Cardiff University	Determining fixed-length paths in edge-weighted graphs
11:00–11:30	**Coffee break**		
11:30–12:30	PS	**Dr. Matthew Jones** Nationwide Building Society	An overview of the application Artificial Intelligence in Financial Services
12:30–13:30	**Lunch**		
13:30–13:50	CT	**Aric Fowler** Cardiff University	The Score Reveal Problem: How do we Measure and Maximise Entertainment?
13:50–14:10	CT	**Yuwei Qi** University of Manchester	Asymptotic Expansions for Valuing Perpetual American Put Options under the Heston Model
14:10–14:30	CT	**Alexandra Zverovich** Cardiff University	Sparse solvers for large unconstrained quadratic programs
14:30–14:50	CT	**Marialis Simoni** University College London	Prediction of the trajectory and location of ice shards in aircraft icing
14:50–15:10	**Poster Prize & Concluding Remarks**		

List of Abstracts – Talks

Thursday 13th June

Thursday First Plenary Speaker (10:00 - 11:00)

Fractional-order calculus in one hour: ideas, methods, and tools

Prof. Igor Podlubny PS

Technical University of Kosice

Fractional calculus is a short name denoting the generalization of differentiation and integration to non-integer orders. We will take a look at the historical development of the ideas of generalized differentiation, geometric and physical interpretations, some methods for evaluation of fractional-order derivatives, fractional-order differential equations and methods for their analytical and numerical solution, and at applications of fractional-order modeling in science and engineering.

Thursday Session 1 (11:30 - 12:30)

Learning to Solve Related Linear Systems

Disha Hegde **CT**

University of Southampton

Solving multiple large linear systems defined across a parameter space is central to many numerical tasks, such as solving nonlinear PDEs arising from applications like fluid dynamics, optimising hyper-parameters of Gaussian processes and finding coefficients for statistical models. The computational expense of solving these linear systems can be lowered if their interdependence across the parameter space is exploited efficiently. This talk extends the idea of probabilistic linear solvers across a space of parameters. This probabilistic solver is used as a companion with standard iterative solvers like the Conjugate Gradient method to provide an efficient initial guess and preconditioner that accelerate the convergence.

Mathematical Programming for Scheduling Telemedicine Appointments

Charlie Marshall **CT**

Cardiff University

With telemedicine coming to the forefront during the COVID-19 pandemic, flexibility in terms of modes of care delivery has emerged. We are working in partnership with TEC Cymru, who worked to rapidly implement video consultations within NHS Wales during the pandemic and continue to promote the use of telemedicine in Wales. In this paper, we consider the scheduling of patients' appointments via three different modes of delivery: traditional face-to-face, video conferencing platforms, and telephone. The solution of the model not only has an impact on satisfying patient and clinician preferences, but also could potentially reduce travel for patients and staff. We model the problem as a multi-mode resource constrained project scheduling problem, with the aim of maximising patient and clinician preferences for delivery method. Two model formulations are presented to solve this problem. The first assigns appointments to timeslots while the second formulation assigns an ordering of appointments. We compare these two models, evaluating which is more useful in different scenarios.

The combined effects of heterogeneous susceptibility and non-pharmaceutical interventions on epidemic trajectories

Ibrahim Mohammed **CT**

University of Strathclyde

It has recently been established that individual variation in susceptibility lowers herd immunity thresholds. Using an SEIR model with gamma distributed traits it was shown that variation in susceptibility flattens epidemic curves in a natural way – an effect that can sometimes be misattributed to interventions. Given epidemic data in which non-pharmaceutical interventions (NPIs) were imposed to control an outbreak, estimating both the effect of the intervention and the coefficient of variation of susceptibility becomes complicated as both perform a similar task of flattening the curve. Our research seeks to address this challenge by conducting simulated epidemic studies and statistical inference.

We simulated epidemics of a respiratory viral disease such as covid -19 using known values of parameters of interest from literature to represent the disease dynamics, heterogeneity, and the impact of NPIs. For each combination of parameters 200 data sets were simulated and we fitted models with heterogeneity in susceptibility to estimate the basic reproduction number, coefficient of variation, and intervention parameters while keeping other parameters constant. Our results indicate that there exists some degree of correlation between the coefficient of variation and the non-pharmaceutical intervention, but this can be overcome by creative study designs.

Thursday Second Plenary Speaker (13:30 - 14:30)

C^∞ well-posedness of higher order hyperbolic equations with multiplicities

Prof. Claudia Garetto PS

Queen Mary University of London

In this talk with I will present some recent results obtained in collaboration with Bolys Sabitbek (QMUL) on higher order hyperbolic equations with multiplicities. Particular focus will be given to the conditions on the lower order terms (Levi conditions) required to obtain C^∞ well-posedness of the corresponding Cauchy problem.

Thursday Session 2 (14:30 - 15:30)

The Mathematics of Balance

Javier Chico Vazquez **CT**

University of Oxford

Fluid dynamics within the vestibular system are crucial for maintaining balance in humans. Within the inner ear are semicircular canals filled with a viscous fluid called endolymph, interconnected by a voluminous cavity termed the utricle. Rotational motion generates a fluid flow within this system prompting deflection of an elastic membrane called the cupula, subsequently eliciting responses from sensory hair cells that transmit signals to the nervous system.

We aim to expand current models by considering semicircular canals with non-uniform widths to better understand the role of the utricle. By deriving and asymptotically solving the equations governing fluid motion within these toroidal channels, we can account for variations in width that reflect utricular function. We introduce new solution methods, resulting in accurate leading-order solutions up to second order in the small aspect ratio between the width of the canal and its arc length.

Using our refined model, we can predict how the body responds to rotational stimuli and evaluate manoeuvres aimed at preventing or reducing instances of balance disruption. In particular, we use this model to investigate simple situations such as: after spinning around a fixed number of times, is there an optimal degree of counter-spinning that minimises the sensation of dizziness?

This research enhances our understanding of the mechanisms underlying balance regulation, with potential implications for developing therapeutic interventions or vestibular prosthetics.

Eigenvalue Bounds for Perturbed Periodic Dirac Operators

Ghada Shuker Jameel **CT**

Cardiff University

Consider the one-dimensional Dirac operator $H = H_0 + V$ in $L^2(\mathbb{R})^2$,

$$H = -i\sigma_2 \frac{d}{dx} + m\sigma_3 + q(x) + V(x) \qquad (x \in \mathbb{R}),$$

where σ_2, σ_3 are Pauli matrices, and $m \geq 0$ is the particle mass, q is real-valued and periodic of period a and V is a 2×2 matrix-valued function with entries in $L^1(\mathbb{R})$. The free Dirac operator H_0 is self-adjoint and its spectrum has a band-gap structure, i.e. it is purely absolutely continuous and consists of a sequence of closed intervals in $\mathbb{R}$. The Dirac operator $H = H_0 + V$ has the same essential spectrum as H_0 but can have additional eigenvalues in $\mathbb{C}$. We aim to establish regions in $\mathbb{C}$ which contain all eigenvalues of H. We have proved that $\lambda \in \mathbb{C}$ cannot be an eigenvalue if

$$\|V\|_1 < \Gamma(M(\lambda))\gamma_+(\lambda)\gamma_-(\lambda),$$

where $M(\lambda)$ is the monodromy matrix of the periodic problem and Γ is a matrix function related to the angle between the eigenvectors of the matrix; $\gamma_+(\lambda), \gamma_-(\lambda)$ relate to the size of Floquet solutions of the periodic problem. We then show that $\gamma_\pm(\lambda)$ are strictly positive and that $\Gamma(M(\lambda))$ is strictly positive except at the end-points of spectral bands, where it tends to 0.

Continuum modelling of particulate flows

Rhys James **CT**

Cardiff University

Modelling granular flows is challenging, primarily because there is no widely accepted unified rheology that spans all flow regimes. Unlike fluids, where relationships like the Navier-Stokes equations or their derivatives, such as Stokes flow, can describe fluid motion, no such relationship exists for granular materials. Instead, the behaviour of granular flows is considered based on their regime, for example: gas-like, fluid-like, or solid-like. My research focuses on these flow regimes and the development and application of numerical methods to effectively model granular flows, with a particular emphasis on meshless continuum methods like smoothed particle hydrodynamics (SPH). In this talk, I will briefly discuss the fundamentals of granular flow rheology, particularly the μ(I)-rheology, and the derivation of smoothed particle hydrodynamic approximations.

Friday 14th June

Friday First Plenary Speaker (09:00 - 10:00)

Morphing Triangular Frameworks

Dr. Isaac Chenchiah

PS

University of Bristol

A morphing structure can change its shape in response to its environment. For example, a morphing aerofoil would adjust its shape to the surrounding atmospheric conditions and flight regime (e.g. take-off, cruising, landing). Another example is a medical implant that could adapt as the patient grows or ages, thus reducing the need for subsequent surgical intervention.

In this talk, we explore a class of morphing structures: planar triangular frameworks comprised of bi-stable edges. We explore their low-energy states and characterise all stable hexagonal shapes, including those with an annulus.

This is joint work with Matthew O'Donnell at the University of the West of England.

Friday Session 1 (10:00 - 11:00)

Analysing Network Dynamics: The contagion effects of SVB collapse on the US Tech Industry

Fan Wu **CT**

Cardiff University

Network analysis in modelling financial contagion has developed significantly since 2016 based on a review of the literature. The recent collapse of Silicon Valley Bank in 2023 marks the second-largest bank failure in the history of the United States. While its major clients were from the technology sectors, we propose that under the collapse of SVB, there is a contagion effect within the tech industry. We combine LASSOed VAR (Vector Autoregressive) and network analysis to examine static and dynamic volatility risk contagion among 30 tech companies in the US before and after the SVB collapse. We found that the TCI (Total Connectedness Index) shows a downward trend, which indicates the contagion risk decreased after the SVB collapse. Furthermore, we discovered the density of the network dropped and highlighted the key player and the risk transmission path within this network. These results offer insights for different stakeholders to mitigate the risk associated with such failures.

On the L^p convergence of Fourier summation methods

Hrit Roy **CT**

University of Edinburgh

In one dimension, the partial Fourier sums converge in L^p for all $1 < p < \infty$. In two dimensions, there are multiple ways of defining the partial sums, and the convergence problem depends on our choice of summation method. For instance, if we sum the frequencies in squares, or any other polygonal domain, then we get L^p convergence for all $1 < p < \infty$. However, if we sum the frequencies over balls, then L^p convergence fails for all p other than $p = 2$. We explore this phenomenon in this talk, and discuss some key features of a Fourier summation method that determine the range of L^p convergence.

Determining fixed-length paths in edge-weighted graphs

Daniel Hambly **CT**

Cardiff University

In this talk, we consider the NP-hard problem of finding fixed-length paths in edge-weighted graphs. That is, we want to find a path (a sequence of vertices and edges where they can appear in the path at most once) in a network from one point to another where the total length of the path, in terms of the sum of its edge weights, is as close to possible as some prescribed length k. A particular application of interest is that of exercise. A street network can be conceptualised as a graph, where intersections and dead ends act as vertices, and roads as edges. Designing a workout route for activities like walking, running, or cycling, involves determining a path from a starting point to a destination within a specified number of steps, calories to be burned, or distance to cover. The selection of criteria, such as steps, calories, or distance, would define the weights assigned to the edges, making the task akin to identifying a path of a fixed length. Routing services are a feasible option for finding a solution, although they usually focus on routes with minimum length rather than a specific length.

Friday Second Plenary Speaker (11:30 - 12:30)

An overview of the application Artificial Intelligence in Financial Services

Dr. Matthew Jones PS

Nationwide Building Society

The last decade has witnessed an explosion of interest in the application of Artificial Intelligence (AI), driven by its user friendly and game changing applications. Understandably this has stirred up a great deal of excitement and trepidation around AI, orientating around: what is it; opportunities that it can drive; risks/harms it can cause; how it can be managed and what the future holds.

Risk Decision Science & Analytical Innovation have been at the forefront of its application at Nationwide Building Society where different Machine Learning techniques have been applied to enhance Credit Scoring and augment financial crime defences – culminating in multiple financial services industry awards for the team.

In this session, the speaker will provide: an overview of AI; bring it to life via Use Cases at Nationwide; share key risks and thoughts on the future in this focal and growing area in financial services.

Friday Session 2 (13:30 - 14:50)

The Score Reveal Problem: How do we Measure and Maximise Entertainment?

Aric Fowler **CT**

Cardiff University

In many elections or competitions, a set of voters assign points to the candidates in a way that indicates their preferences, with the winning candidate being the candidate with the highest total score. When it comes to revealing the result after all votes have been cast, some competitions proceed by having a roll call where each voter announces their vote in turn. This is often done for entertainment purposes, leading to the introduction of the score reveal problem: Which ordering of the voters should be chosen to maximise the entertainment value of the roll call?

We can define various entertainment measures to cater towards the entertainment of a given spectator, using entertainment properties to categorise them and compare different preferences. After a suitable entertainment measure has been chosen for a given spectator we must find the optimal ordering of the voters, requiring the use of combinatorial optimisation techniques.

Asymptotic Expansions for Valuing Perpetual American Put Options under the Heston Model

Yuwei Qi **CT**

University of Manchester

The valuation of American options under stochastic volatility has attracted considerable interest due to the complexity of calibrating real options with uncertain volatility. In this paper, we consider a free-boundary problem for pricing perpetual American put options under the Heston model and derive novel asymptotic expansions for both the option price and the optimal exercise boundary using perturbation techniques. We demonstrate the difficulty and inefficiency of obtaining accurate valuations for the fully elliptic partial differential equation problem with finite-difference PSOR methods. This leads us to simplify the problem by assuming small volatility of volatility, which usefully reduces the problem to be of parabolic type in one of the dimensions, thereby reducing the computational task considerably, and yet it replicates the solution of the full problem well. This in turn leads to a further asymptotic and even simpler approach found by developing a quite straightforward series solution, based on small but finite volatility of volatility and small displacements of the variance from its long-run mean (a critical region in parameter space). This approach too, when compared with the full benchmark solution, yields remarkably useful results, but at a tiny fraction of the computational cost.

Sparse solvers for large unconstrained quadratic programs

Alexandra Zverovich **CT**

Cardiff University

Linear systems of equations defined by symmetric positive-semidefinite matrices are ubiquitous in mathematics and scientific computing. If the considered matrix is of size $N \times N$ $(N \in \mathbb{N})$, then the worst-case time complexity of solving a general consistent linear system (that is, a system admitting at least one solution) is $O(N^3)$, making the use of direct solvers intractable for problems involving large values of N. In such situations, a common alternative consists of relying on iterative approaches based on the unconstrained minimisation of an associated convex quadratic map; representatives of these types of approaches are for instance the conjugate-gradient and Kaczmarz methods.

However, the solving of such quadratic problems (QPs) can in practice prove to be challenging, especially for problems involving very large values of N and non-sparse matrices. As an alternative, we investigate the possibility to effectively minimise these quadratic maps while strictly restricting the number of matrix-entry calls. We will describe a new class of numerically efficient approximate solvers that exploits the properties of rescaling-invariant pseudoconvex relaxations of the quadratic programs related to such linear systems. The solvers rely on the minimisation of the relaxed problem over specific l_1 -type N-dimensional balls using conditional-gradient-type approaches. The resulting per-iteration worst-case time complexity of the described strategies is $O(N)$ making them suitable candidates for solving large-scale problems. We will discuss the interest of the considered procedures in terms of trade-off between approximation accuracy and number of matrix-column calls, and illustrate their behaviour on a series of examples.

Prediction of the trajectory and location of ice shards in aircraft icing

Marialis Simoni **CT**

University College London

Aircraft icing takes places in clouds at freezing temperatures in high altitude flights, when super-cooled water droplets hit and free upon impact with unprotected surface areas. Ice accretion on the airplane wing can have critical effects on performance, as dealing with a bumpy wing, not a smooth one, might mean that the airflow will go uncontrollably stray. To illustrate, in Indiana USA, in 1994, the American Eagle Flight 4184 crashed, killing all 68 people on board. Ice accumulation on the wing's surface was found to be the cause. Therefore, accurately predicting the trajectory and the location of the ice shards, on the wing, becomes increasingly important. Predicting the location of a collection of solid bodies in an unbounded uniform flow is our goal in this project. Other real life applications of our project could be the falling down of rice grains along an inclined chute. The rice grains, then go through an optical system, which ejects defective grains. As things stand, ”healthy” grains might be ejected, as well, which leads to a minimization of productivity. Providing the optical system with a uniform array of only defective grains, might make the process easier, so that each defective grain is aligned with its respective ejector. There is other applications, but I'm limiting myself to the most important ones. To conclude, one of the rate-limiting factors in cancer metastasis might be the haemodynamic transportation from the damaged vascular walls of the tumor cells. Predicting their trajectory and eventually locating them, might prove to be extremely important, in terms of preventing this exterminating disease.

List of Posters

Thursday 13th, 15:30 - 17:00

Buckling the trend on viscous sheets
Joshua Durrant, *University of Limerick*

Cell Fitness in Differentiation Hierarchies
Iftikhar Ahmed, *Queen Mary University of London*

Eigenvalue Bounds for Perturbed Periodic Dirac Operators
Ghada Shuker Jameel, *Cardiff University*

Empowerment Entropy and Collective Motion
Sam Turley, *University of Warwick*

Modelling ocean wave-induced microplastic transport in the presence of the Basset-Boussinesq history force
Mary Eby, *Heriot-Watt University*

Numerical modelling of stretch-induced instabilities in liquid crystal elastomers
Rabin Poudel, *Cardiff University*

On the L^p convergence of Fourier summation methods
Hrit Roy, *University of Edinburgh*

Price discovery in Bitcoin: Exploring lead-lag dynamics of spot and futures markets
Gabriela Filipkowska, *Cardiff University*

The combined Effects of heterogeneous susceptibility and non-pharmaceutical interventions on epidemic trajectories
Ibrahim Mohammed, *University of Strathclyde*

List of Participants

Participants who agreed to share their names and email addresses are included below.

Plenary Speakers		
Isaac Chenchiah		p.14
Claudia Garetto		p.11
Matthew Jones		p.17
Igor Podlubny		p.8

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Alexandra Zverovich	zverovicha@cardiff.ac.uk	p.19

Useful Information

Registration will take place on the ground floor of the Abacws building, Cardiff between 09:00 and 09:45 on the Thursday. Light refreshments will be provided during this time.

Talks will be held in room **2.26** on the second floor of Abacws building. There are lifts available if required in the North side (right-hand side through the front main entrance) and South side (left-hand side through the front main entrance) of the building.

Coffee breaks and lunches will be offered in room **5.05** on the fifth floor of Abacws building.

The **poster session** will be held on Thursday afternoon in room **5.05**.

There will be a **group conference photo** taken at 12:30 Friday afternoon. We will meet on the ground floor of Abacws for this to be taken.

Eduroam Wi-Fi will be available during the conference. If you are unable to access Eduroam, please contact us prior to the event.

In the event of an evacuation, please use the stairwells in the centre of the building or the wheelchair-accessible stairwells near each of the lifts, unless instructed otherwise. Fire exits on the ground floor can then be found via the main and rear entrances, at the bottom of the stairwells by the lifts, and at the far end of the North and South sides of the building. The assembly point is outside the front of the building.

Gender-neutral toilet facilities are available on the ground floor of the building. There are also two gender-neutral, accessible toilet facilities available on each floor of the building.

The **conference dinner** will be held at the Henrys Café Bar in Cardiff city centre at 6:30pm on Thursday 13th June.

Henrys Café Bar
Park Chambers
Park Pl
Cardiff
CF10 3DN
Location

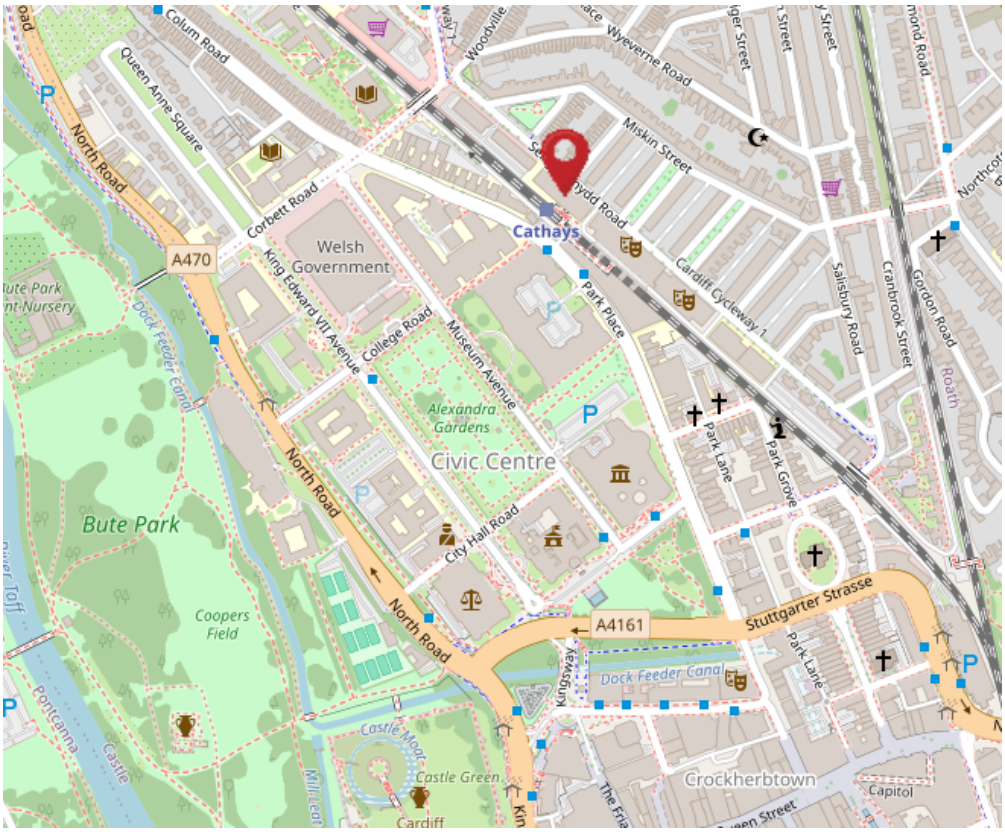
How to get to Abacws?

The conference will be held in the newly built Abacws building, located at Senghennydd Rd, Cardiff, CF24 4AG.

We are a 30 minute walk from Cardiff Central Train Station or alternatively, Cathays Train Station is located right next to the building and is only a 10 minute journey from Cardiff Central. Please note, there is no lift at Cathays Train Station. If you do require disabled access, please contact us and further instructions can be provided.

- **Train:** Direct trains are available from Cardiff Central at an approximate cost of £3.10 for a single ticket. Approximately five trains run per hour.
- **Airport:** Cardiff Airport can be accessed via both train and bus.
  - There is a rail link that connects Rhoose Cardiff International Station with Cardiff Central.
  - The 905 shuttle bus provides a link between the passenger terminal and Rhoose Railway Station for connections to Cardiff city centre. This shuttle service operates hourly, seven days a week, aligning with the train schedule at Rhoose Station.
  - The 304 bus service, which also runs hourly, connects the airport to Cardiff city centre. The 304 bus departs from Customhouse Street in Cardiff city centre.

With respect to Abacws's location within Cardiff, please refer to the map below.



Partner Institutions and Sponsors

The 2024 UK National SIAM Student Chapter conference was funded by SIAM and the Cardiff University Doctoral Academy.

We are also appreciative of support received from the Cardiff University School of Mathematics and Abacws building facilities team.

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