

# **ONLINE Course on Engineering Structures Under Fire & Blast**

**15<sup>th</sup> -16<sup>th</sup> April  
2024**



## **ABOUT THE COURSE**

The Lecture includes Structural Response under blast loading. The fundamental of blast loading such as the Principle of the scaling law, blast profile are introduced. The basic design principles in the relevant design guidance such as SCI (1999), TM5-1300(1990) will be also introduced, which include numerical method (classical solution and incremental solution) to solve the structural response; The way to assess the structural response and human response using Iso-Damage diagrams (Pressure- Impulse diagrams); design procedure for steel and reinforced concrete members under the blast loading.

This syllabus also includes Structural Response under Fire. Basics of fire physics and the engineering idealisations made to characterise fire induced “loading” on structural systems. Detailed description of the key features of behaviour of common engineering materials (primarily steel and concrete) under high temperatures and the key responses expected when simple structural systems are exposed to fire. Traditional methods of design to ensure adequate fire resistance and recent trends towards performance-based engineering in a probabilistic framework.

On completion of the course you will be able to apply a sound knowledge of various technologies for checking response of structures under fire and blast loading.

## **WHO SHOULD ATTEND**

The course is intended for Engineers, Operations’ managers, Applied Scientists and Technologists interested in design & structure under blast loading. Engineers, managers and scientists involved in design, assessment and management of a wide range of engineering structures will also benefit from this course.

### **COST**

The registration fee of the workshop will be £650 +VAT (UK VAT ONLY) which includes course notes.

### **COURSE MATERIAL**

The lecture notes will be sent in advance.

### **PAYMENT**

Payments can be made by cheque (made payable to ASRANet Ltd.), cash or bank transfer. Please enquire for details.

### **CONTACT**

ASRANet  
Limited

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# PROGRAMME

## Monday 15<sup>th</sup> April 2024

- 09.00 – 10.30 **Lecture 1: Effects of blast loading on material characteristics**  
*Dr Feng Fu*
- 10.30 - 10.45 *Break*
- 10.45 - 12.15 **Lecture 2: Blast response analysis using closed form, approximated simplified methods**  
*Dr Feng Fu*
- 12.15 - 13.30 *Lunch*
- 13.30 - 15.00 **Lecture 3: Numerical modelling for the analysis of structures under blast and pressure impulse diagrams**  
*Dr Feng Fu*
- 15.00 – 15.30 *Break*
- 15.30 - 17.00 **Lecture 4: Codified Design examples for blast resistant structures.**  
*Dr Feng Fu*

## Tuesday 16<sup>th</sup> April 2024

- 9.00 - 10.30 **Lecture 5: Basic knowledge of fire**  
*Dr Feng Fu*
- 10.30 - 10.45 *Break*
- 10.45 - 12.15 **Lecture 6: Mechanical properties of steel and concrete under elevated temperatures**  
*Dr Feng Fu*
- 12.15 - 13.30 *Lunch*
- 13.30 - 15.00 **Lecture 7: Fire safety design for buildings**  
*Dr Feng Fu*
- 15.00 - 15.30 *Break*
- 15.30 - 17.00 **Lecture 8: Modelling technique for structural fire analysis**  
*Dr Feng Fu*

## LECTURE CONTENT

### **Lecture 1: Effects of blast loading on material characteristics.**

This lecture begins with an overview of the blast effects on structures. The lecture then proceeds with detailed discussion on the blast loads. The Principle of the scaling law, blast profile is introduced. Material behaviour of structural members at high strain rate will be covered

### **Lecture 2: Blast response analysis using closed form, approximated simplified methods.**

This lecture deals with the calculation of the blast response of structures using simplified methods, namely single-degree-of-free (SDOF) method for the overall response predictions; analysis of element response using energy method; analysis of element response using equivalent SDOF method.

### **Lecture 3: Numerical modelling for the analysis of structures under blast and pressure impulse diagrams.**

This lecture deals with the analysis of the blast response using numerical simulation approach. The way to assess the structural response and human response using Iso-Damage diagrams (Pressure-Impulse diagrams) will also be covered.

### **Lecture 4: Codified Design examples for blast resistant structures.**

The detailed example of Design of element in steel or reinforced concrete under blast will be demonstrated.

### **Lecture 5: Basic knowledge of fire.**

This lecture provides an overview of fire science and fire safety engineering in order to set the subsequent material in its proper context. The fundamentals of heat transfer, including conduction, convection and radiation, are introduced, as an understanding of these is central to any fire safety design.

### **Lecture 6: Mechanical properties of steel and concrete under elevated temperatures.**

These widespread structural materials suffer a marked degradation in their mechanical properties due to the action of a fire. The focus will be on steel, as it is particularly susceptible to thermal attack and requires carefully fire protection.

### **Lecture 7: Fire safety design for buildings.**

Give an introduction to prescriptive design for steel according to EN 1993-1-2. Detailed fire safety design knowledge, such as compartmentation, and evacuation route design.

### **Lecture 8: Modelling technique for structural fire analysis.**

This lecture will focus on the effective way to model the behaviour of the structure under fire. Different modelling techniques and software such as Ozone, CFAST will be introduced.

## LECTURER CV'S

### Dr Feng Fu, City University London



#### **Dr Feng Fu Ph.D. MBA, CEng, FStructE, FICE, FASCE, FHEA**

Dr Feng Fu is the Council Member of Institution of Structural Engineers ( IStructE) in 2020 and Chair for North Thames Regional Group of IStructE in 2020. He is an Associate Editor , Journal of Performance of Constructed Facilities, American Society of Civil Engineers (ASCE) and Associate Editor, Proceedings of the Institution of Civil Engineers - Structures and Buildings. He is a Chartered Structural Engineer, Fellow of Institution of Structural Engineers, Fellow of American Society of Civil Engineering and Fellow of Institution of Civil Engineers.

Prior to joining academia, he worked for several world leading consultancy companies and was involved in the design of extensive prestigious construction projects worldwide, such as the tallest building in Western Europe, the Shard in London. He worked at advance analysis team in WSP Group Ltd London followed his work as a Structural Engineer in Waterman Group Ltd London. In China, He also worked as a structural engineer for one of the best and the oldest design institute in China, Beijing Institute of

Architectural Design and Research (the designer of Beijing Olympic Games Stadiums and Guardian list of seven wonders of the modern world, Beijing Daxing Airport) before his study of PhD in UK. When he was doing his Master in Structural Engineering, he worked as a research assistant in China Academy of Building research, worked on research projects funded by National Natural Science Foundation of China. He received his PhD in Structural Engineering from University of Leeds, MSc in software Engineering from University of Oxford and MBA from University of Manchester. He obtained his MSc and BSc in Structural Engineering from Beijing University of Technology respectively.

Dr Fu has extensive research experience in the area of progressive collapse, structural fire analysis of tall buildings and long span structures, Tensegrity structures and composite joints. He specialized in advanced numerical modelling and developed several modelling programs using different programming languages. He also carried out several full scale tests on composite joints. His recent research has been focused on investigating the behavior of high-rise buildings, bridges and offshore structures under extreme loads such as blast and fire using advanced 3-D numerical modelling techniques.

He has published more than 100 peer reviewed technical papers with a Google Scholar h-index 22. He is also the reviewer for more than 40 international Journals. He is also the editorial board member for three international journals, voting member for two design codes of ASCE. He is the author of Four

books: Fu, F. (2018). *Design and Analysis of Tall and Complex Structures*, Elsevier. Fu, F. (2016). *Structural Analysis and Design to Prevent Disproportionate Collapse*. CRC Press. Fu, F. (2015). *Advanced Modeling Techniques in Structural Design*, Wiley; Fu, F. (2021) *Fire Safety Design for Tall Buildings*. CRC Press