Citation for the Degree of Doctor of Science in Engineering, honoris causa,
Sir Gerhard Jacob Zunz

Gerhard Jacob (Jack) Zunz was born in Germany on the 25th of December 1923. His family returned to South Africa while Jack was a young child and after matriculating at the end of 1941, he attended the University of the Witwatersrand, Johannesburg (Wits). Jack volunteered for military service in World War II, and from 1943, he interrupted his studies at Wits to join a South African artillery regiment, serving in Egypt and Italy. Although he claims not to be a courageous man, he joined because "*my conscious would not forgive me if I didn't*". On demobilisation in 1946, Jack resumed his studies in the Department of Civil Engineering at Wits and completed his BSc in Engineering as one of the illustrious "class of '48" (They were mostly ex-servicemen). The degree was formally conferred at a ceremony in March 1949.

He commenced work in the steel design and fabrication industry, but soon moved to London where he joined Ove Arup and Partners in 1950. The company, now one of the largest multi-disciplinary engineering design firms in the world, was still in its infancy, but the founder, Ove Arup, recognized the potential of young Jack. In 1954, Jack returned to South Africa to start the South African branch of Ove Arup. The firm was awarded the design of the Sentech Tower, commonly known as the Brixton Tower. This iconic structure on the Johannesburg skyline, which required state-of-the-art engineering in its day, is 237 m high and can resist winds of 200 km/hr, deflecting as much as 2 m without damage.

In Australia, the New South Wales government announced that Danish architect Jørn Utzon had won an international competition for the architectural design of the new Sydney Opera House. The decision was based on sketchy drawings produced by Utzon, and as artistically inspirational as Utzon's proposal was, neither the judging panel nor Utzon appreciated the engineering challenges that his proposal would involve. Ove Arup and Partners were appointed as the structural engineers.

Utzon's proposal required a highly complex arrangement of unique shell shapes, resembling the billowing sails of a ship. Political considerations were massive, and work started long before any serious resolution of the engineering issues. In 1961, Jack returned to Ove Arup in London, and was tasked with overall leadership of the project. By then, various approaches to the roof structure had been abandoned due to the unacceptable forces and bending moments. The work had included collaboration with academia, using instrumented scaled models and wind tunnel testing,

The engineering solution that was ultimately implemented was proposed under Jack's leadership and with Utzon's full collaboration. It involved constructing the shells from a fanlike series of precast concrete arch ribs, each made of multiple subsections, an approach unprecedented for a roof, especially on such a large scale. To make construction feasible, every arch would be formed from the surface of a single sphere. The resulting constant curvature meant re-use of the same curved formwork for every arch segment. This key decision facilitated the rapid, precise and economical construction of the roof. (Note – it's not technically a shell now.)
Jack and the Arup team of engineers represented some of the finest minds in structural engineering in the world. Under Jack's leadership, it took their combined efforts for a number of years to solve all the major problems of this structure which is ranked amongst the

most complex engineering challenges of the twentieth century. The geometrical complexity led to a first in the use of computers in structural design as three old-fashoined computers and in-house developed special software clocked thousands of hours of computation time. The engineering complexity was unprecedented and many new techniques in structural engineering were developed. The design was completed in 1963 and construction of the structure finished in 1967.

All the while, the project was mired in controversy — the complexity as well as the time and cost overruns (about 10 times the original estimated cost) led the Australian media to brand the project an "engineer's folly", a waste of tax payers money, and it was described as an "unmitigated bitch to build". But it turned out to be, without doubt, a "once-in-a-century" project and became an icon for Australia.

Although the Sydney Opera House is considered a pinnacle of Jack's career, he went on to lead the design of many other structures with some of the most famous architects of the day, including Britannic House for BP, Standard Bank Building in Johannesburg with its hanging floors, Emley Moor Transmission Tower (then the tallest structure in the UK), the iconic HSBC Headquarters in Hong Kong and the Stanstead Airport Terminal.

One of Jack's enduring qualities is his unfailing acknowledgement of his colleagues' contributions. For example, he credits his Wits classmate and colleague, the late Michael Lewis, who worked with him in South Africa (and also rose to the highest level in Arup), who led the Sydney-based part of the team on the Opera House project, as being an outstanding and dedicated engineer and as the '*doer*' without whom he may never have completed his undergraduate group project at Wits. As another example, Jack said about his Ove Arup colleagues in relation to the Opera House: "*... this unusual structure is a tribute to their skill and ingenuity.*"

Perhaps the most reliable indicator of an engineer's greatness is the regard in which they are held by their colleagues. For example Dr John Nutt, an eminent engineer and former chairman of Arup Australasia, who worked with Jack on the Opera House, set up the Zunz lecture series at the University of Technology Sydney. This lecture series is described on their website as follows: "*The lecture series was named in honour of the work of Sir Jack Zunz, a brilliant British engineer who led the design team on the Sydney Opera House as a partner of Sir Ove Arup. His approach to engineering and education was inspirational. "The firm also created the 'Jack Zunz Scholarship' to provide advanced study opportunities for it's most talented young engineers globally.*

In recognition of his achievements, Jack Zunz was Knighted (Knight Bachelor) in 1989. Sir Jack received many other prestigious awards including: Institution of Structural Engineers Gold Medal (1988); Honorary Doctor of Engineering from University of Glasgow (1994); Honorary Doctor of Science from the University of Western Ontario (1993); Fellow of the Institution of Civil Engineers (1966); Fellow of the Institution of Structural Engineers (1965); Fellow City of Guilds Institute (1990); Honorary Fellow of the Royal Institute of British Architects (1990); Fellow Commoner at Churchill College, Cambridge (1967-68); Fellow of the Royal Academy of Engineering (1983); Honorary Member of the Architectural Association (2011); Oscar Faber Silver Medal (1968); Oscar Faber Bronze medal (1988); Institution of Structural Engineers Silver Medal Award (1983); Honorary Fellow of Trevelyan College, Durham University (1996).

Jack Zunz became Chairman of the Ove Arup group from 1977 to 1984 and later Co-chairman of the firm globally from 1984 to 1989. By this time, Ove Arup had grown into an international corporation with 90 offices in 30 countries, still adhering to the founding values of Ove and Jack.

The Ove Arup group is owned and controlled by employees through charitable trusts, which came about through Jack Zunz's influence. As stated by Jack, "*Real investment means selecting, training, educating, retaining and reeducating the people who create wealth of the country.*" Philanthropic activities through the Ove Arup Foundation was largely spearheaded by Jack, "*...supporting the advancement of education directed towards the promotion, furtherance, and dissemination of knowledge of matters associated with the built environment, and public perception of the build environment.*" One of the hallmarks of the Arup today remains the concept of "total design", integrating all the parts into an effective and socially relevant whole, pioneered by Ove and Jack.

In light of his vast contributions to the built environment, we consider it fitting to award to Gerhard Jacob Zunz, the degree Doctor of Science in Engineering *honoris causa*.