



**Professor Sigrid Adriaenssens**

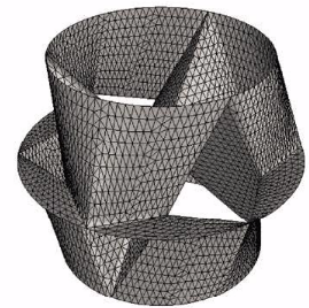
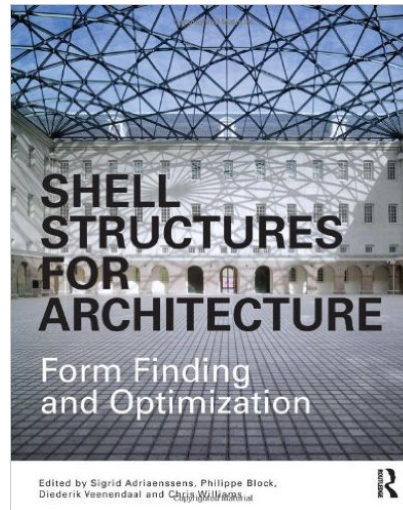


Figure 1: Initial mesh in perspective view

**The middle image is from:** Adriaenssens S, Block P, Veenendaal D, Williams C, editors. Shell structures for architecture: form finding and optimization. London: Taylor and Francis – Routledge; 2014

**The rightmost image is from:** Ruy Marcelo O. Pauletti, Sigrid Adriaenssens, Alexander Niewiarowski, Victor Charpentier, Max Coar, Tracy Huynh and Xi Li, “A minimal surface membrane sculpture”, Proceedings of the IASS Annual Symposium, Hamburg, Germany, September 25-28, 2017

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Director, Program in Mechanics, Materials and Structures, Civil and Environmental Engineering  
Princeton University, Princeton, New Jersey, USA

### **Education:**

PhD University of Bath, Bath, United Kingdom, 2000.

MPhil University of Bath, Bath, United Kingdom, 1997.

B.Eng. Civil / Structural Engineering Department of Architecture and Civil Engineering, University of Bath, UK, 1995.

### **Research Areas:**

Dr. Adriaenssens’s research focuses on lightweight surface systems and how they can be optimized and realised to interact with extreme structural or environmental loading. This includes research on flexible and rigid shells and plates, submerged flexible membranes and nets, and metamaterials with applications for a resilient urban environment. The applications range from adaptive building shading devices to large-scale inflatable storm

surge barriers and are sometimes inspired by systems that evolved in biology, art or architecture. Dr. Adriaenssens' research spans analytical approaches to study non-linear mechanics, seeking new numerical form finding, optimization and machine-learning approaches and fluid-interaction models as well as experimental aspects based on prototyping of small and medium scale systems using CAD/CAM and robotic construction.

## **Selected Publications**

### **Book:**

Adriaenssens S, Block P, Veenendaal D, Williams C, editors. Shell structures for architecture: form finding and optimization. London: Taylor and Francis – Routledge; 2014

Journal Articles, etc.:

S. Adriaenssens, MR. Barnes, C. Williams, A new analytical and numerical basis for the form-finding and analysis of spline and gridshell structures. In Kumar B, Topping B editors. Computing device in civil and structural engineering. Edinburgh: Civil Comp. Press; 1999. p. 83–90.

S. Adriaenssens and M. Barnes. Tensegrity spline beam and grid shell structures. *Engineering Structures*, 23(1):29–36, 2001.

S. Adriaenssens, “Feasibility study of medium span spliced spline stressed membranes”, *International Journal of Space Structures*, Vol. 23, No. 4, 2008

Sigrid Adriaenssens, Laurent Ney, Eric Bodarwe and Chris Williams, “Dutch maritime museum: Form-finding of an irregular faceted skeletal shell – Part b”, *Proceedings of the International Association for Shell and Spatial Structures (IASS)*, Universidad Politecnica de Valencia, Spain, 28 September – 2 October 2009

Tine Tysmans, Sigrid Adriaenssens and Jan Wastiels, “Shape optimization of small span textile reinforced cementitious composite shells”, *Proceedings of the International Association for Shell and Spatial Structures (IASS)*, Universidad Politecnica de Valencia, Spain, 28 September – 2 October 2009

Tine Tysmans, Sigrid Adriaenssens, Heidi Cuypers and Jan Wastiels, “Structural analysis of small span textile reinforced concrete shells with double curvature”, *Composites Science and Technology*, Vol. 69, pp 1790-1796, 2009

Evrard Fauche, Sigrid Adriaenssens and Jean H. Prevost, “Structural optimization of a thin-shell bridge structure”, *Journal of the International Association for Shell and Spatial Structures (JIASS)*, 2010

T. Tysmans, S. Adriaenssens, J. Wastiels and O. Remy, “Textile reinforced cement composites for the design of very thin saddle shells: A case Study”, 18th International Conference on Composite Materials, 2011

A. P. Thrall, M. Zhu, J. K. Guest, I. Paya-Zaforteza, and S. Adriaenssens, “Structural optimization of deploying structures composed of linkages,” *Journal of Computing in Civil Engineering*, vol. 28, no. 3, Article ID 04014010, 2012.

Adriaenssens S, Ney L, Bodarwe E, Williams C (2012) Finding the form of an irregular meshed steel and glass shell based on construction constraints. *J Archit Eng* 18(3):206–213

Niki Cauberg, Tina Tysmans, Sigrid Adriaenssens, Jan Wastiels, Marijke Mollaert and Bachir Belkassam, “Shell elements of textile reinforced concrete using fabric formwork: A case study”, *Advances in Structural Engineering*, Vol. 15, No. 4, pp 677-689, April 2012

Barnes M., Adriaenssens S, Krupka M. A novel torsion/bending element for dynamic relaxation modeling. *Comput. Struct.* 2013; 119(1): 60–67.

James Norman Richardson, Sigrid Adriaenssens, Rajan Filomeno Coelho and Philippe Bouillard, “Coupled form-finding and grid optimization approach for single layer grid shells”, *Engineering Structures*, Vol. 52, pp 230-239, July 2013

Sigrid Adriaenssens and David P. Billington, “Nervi’s cantilevering stadium roofs: Discipline of economy leads to inspiration”, *Proceedings of the International Association for Shell and Spatial Structures (IASS)*, Wroclaw University of Technology, Poland, 23-27 September 2013

Edward M. Segal and Sigrid Adriaenssens, “Norfolk Scope Arena: A US dome with unique configuration of interior ribs and buttresses”, *Proceedings of the International Association for Shell and Spatial Structures (IASS)*, Wroclaw University of Technology, Poland, 23-27 September 2013

Halpern, A. B., & Adriaenssens, S. (2014). Nonlinear elastic in-plane buckling of shallow truss arches. *Journal of Bridge Engineering*, 20(10), 04014117.

Sigrid Adriaenssens, Nathan Brown, Rosa Lowinger and Jorge Hernandez, "Structural analysis of reinforced concrete folded hyperbolic paraboloid: A case study of the modern Miami Marine Stadium", *International Journal of Architectural Heritage*, Vol. 8, pp 498-516, 2014

Masaaki Miki, Sigrid Adriaenssens, Takeo Igarashi and Ken'ichi Kawaguchi, "The geodesic dynamic relaxation method for problems of equilibrium with equality constraint conditions", *International Journal for Numerical Methods in Engineering*, Vol. 99, pp 682-710, 2014

L. Rhode-Barbarigos, V. Charpentier, S. Adriaenssens and O. Baverel, "Dialectic form finding of structurally integrated adaptive structures", *American Journal of Engineering and Applied Sciences*, Vol. 8, No. 4, pp 443-454, 2015

Tim Michiels, Sigrid Adriaenssens and Landolf Rhode-Barbarigos, "Size optimization of a cylindrical thin shell subjected to 1992 Landers earthquake", *Proceedings of the International Association for Shell and Spatial Structures (IASS)*, Amsterdam, The Netherlands, 17-20 August 2015

Victor Charpentier, Sigrid Adriaenssens and Olivier Baverel, "Large displacements and the stiffness of a flexible shell", *International Journal of Space Structures*, Vol. 30, Nos. 3-4, 2015

M. Streeter, L. Rhode-Barbarigos and S. Adriaenssens, "Form finding and analysis of inflatable dams using dynamic relaxation", *Applied Mathematics and Computation*, 2015 (in press according to the pdf file)

Tim Michiels, Lu Lu, Russell Archer, Sigrid Adriaenssens and Greta Tresserra, "Design of three hyper roofs made of guadua bamboo", *Journal of the International Association for Shell and Spatial Structures, Special Issue: New Directions for Shell Structures*, edited by S. Adriaenssens and P. Block, Vol. 58, No. 1, 2017

Ruy Marcelo O. Pauletti, Sigrid Adriaenssens, Alexander Niewiarowski, Victor Charpentier, Max Coar, Tracy Huynh and Xi Li, "A minimal surface membrane sculpture", *Proceedings of the IASS Annual Symposium, Hamburg, Germany, September 25-28, 2017*

Nyema Wesley, Ruy M.O. Pauletti, Leila C. Meneghetti and Sigrid Adriaenssens, "The impact on pneumatic and catenary forms on the design of thin concrete shells", *CILAMCE 2017*, 2017

Tim Michiels, Sigrid Adriaenssens and Juan Jose Jorquera-Lucerga, "Parametric study of masonry shells form-found for seismic loading", *Journal of the International Association for Shell and Spatial Structures, (IASS)* December 2017

Tim Michiels and Sigrid Adriaenssens, "Identification of key design parameters for earthquake resistance of reinforced concrete shell structures", *Engineering Structures*, Vol. 153, pp 411-420, December 2017

Giulia Tomasello, Stefano Gabriele and Sigrid Adriaenssens, "R-Funicularity of shell structures under dynamic load: The influence of the shape", *Publisher not identified in the pdf file.*, April 2018

Victor Charpentier, Sigrid Adriaenssens and Olivier Baverel, "Adaptive thin shells: An overview of analysis methods", *Publisher is not identified in the pdf file*, May 2018, DOI: 10.13140/RG.2.2.14003.73765

Ruy M.O. Pauletti, Sigrid M. Adriaenssens and Amber Lin, "Numerical modeling of the activation and the snap-through instability of a bending-active umbrella", *Publisher is not identified in the pdf file.*, May 2018

Tim Michiels, Matthew Dejong and Sigrid Adriaenssens, "The optimal form of corrugated shells designed to withstand earthquakes", *Proceedings of the IASS Symposium, MIT, Boston, USA, July 16-20, 2018*

Tim Michiels, Sigrid Adriaenssens, and Matthew Dejong. "Form finding of corrugated shell structures for seismic design and validation using non-linear pushover analysis." *Engineering Structures* 181 (2019): 362-373.

Giulia Tomasello, Sigrid Adriaenssens and Stefano Gabriele, "Dynamic behavior of form-found shell structures according to Modal and Dynamic Funicularity", *Engineering Structures*, Vol. 198, Article 109521, 1 November 2019

Victor Charpentier and Sigrid Adriaenssens, "Effect of gravity on the scale of compliant shells", *Biomimetics*, Vol. 5, No. 4, 2020

J. Goodglass, A. Niewiarowski and S. Adriaenssens, "Mechanical behavior of a new type of flexible, pressurized storm surge barrier under hydrostatic loading", *2nd International Conference on New Horizons in Green Civil Engineering (NHICE-02)*, Victoria, BC. Canada, April 29-May 1, 2020