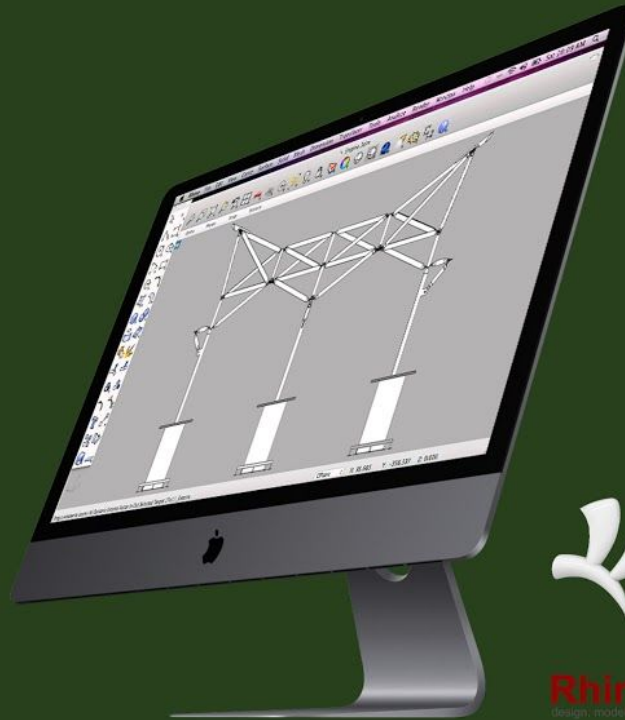


# 3D DESIGN IN BAMBOO

A five-day intensive course for experienced designers using 3D modeling software for building with bamboo.



**RhinoCeros**  
design model present analyze realize

**OCTOBER 7-11<sup>TH</sup>, 2019  
PANAMA**

Course lead: John Naylor, UK architect at Grimshaw, London.  
With: César Cheng, architect at Suma.  
Collaborators: Anand Devarajan  
Raisa Banfield  
Jörg Stamm

INVESTMENT: \$650.00

[INFO@GEOVERSITY.ORG](mailto:INFO@GEOVERSITY.ORG)

Organizer:   
Hosted by:   
Creamos bosques.

# 3D Design in Bamboo

A five-day intensive course for experienced designers on using 3D modeling software for building with bamboo.



## Introduction

This will be an intensive course in which participants will be introduced to bamboo and a selection of 3D modelling software. Participants will use a base design which is the '*Rosa de Los Vientos*' roof system in response to an actual architectural brief. This will then be modelled in the computer by learning Rhinoceros 3D, and then a component will be selected within the design to develop through parametric software to create design options.

The course will focus on the setting and requirements of office facilities for a EUROCLIMA+ global climate change project in the upper Mamoní Valley. The structure and roof will be incorporated into the meeting space planned for that facility located on land owned by Fundación Geoversity in the village of El Valle in the Mamoní Valley Preserve. The mentioned project concerns non-carbon benefits, including the option of focusing on sustainable housing, ecotourism infrastructure and potentially the entire bamboo value chain. The structure will therefore benefit all four communities in the valley and serve as inspiration for the project on this location.

## Agenda

The UN Sustainable Development Goal 11 (SDG11) requires that by 2030 all require adequate, safe and affordable housing and suggests that the building of sustainable and resilient buildings utilising local materials should be a catalyst for development [1]. In 2014 the percentage of the Panama urban population living in slums was higher than India at 25.8% [2]. Panama's celebrated building boom, has also affected many which have seen housing made less affordable [3]. Secure resilient housing is key to developing a countries economy and by 2030 if Panama is to achieve SDG 11, and address the need for all for adequate, safe and affordable housing, then architects are going to have to work practically and adventurously with locally available, natural sustainable materials such as bamboo. In recent years, the Government of Panama and the chambers of commerce have, to their credit, chosen to promote sustainable ecotourism. We are now seeing a high degree of government and private sector receptivity to the natural design with natural materials ideas that Geoversity Design has been promoting over the last four years. The governing authorities of the indigenous territories and comarcas of Panama have also expressed keen interest in using bamboo and other natural materials in the construction of culturally appropriate and affordable housing and eco touristic facilities.

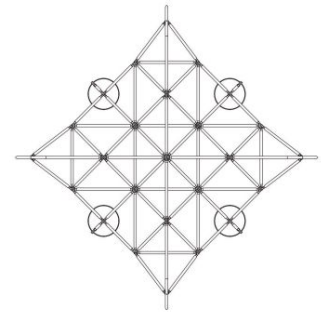
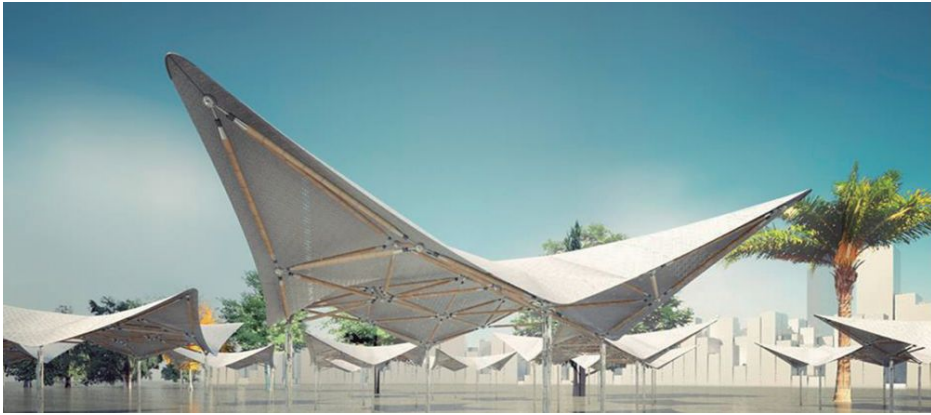
Tropical economies are large producers of bamboo, a material with good tensile and compressive properties and a low carbon footprint when sourced locally. Bamboo will degrade if not designed or built correctly. Exposure to UV light and moisture can bleach, crack and encourage fungal growth causing structural and aesthetic damage which impacts greatly the perception of bamboo in the mind of potential end users, reinforcing the notion of bamboo as temporary, or the 'poor man's timber'. In order to reduce the cost of design and change this negative perception of bamboo, there have been moves by architects to develop a greater synthesis between their current computational design processes and materials with natural variability such as bamboo. Computational design tools allow the architect to visualise ideas and they can be modified and analysed interactively, though this modification can still be time consuming. Parametric software allows us to build on this process and specify relationships among parameters and instantly output versions or iterations of a design, based on associative rules set by the designer.

This course will offer participants the chance to explore the gap between computational design software and the realities bamboo construction. Participants will learn about bamboo and how architects should design for durability using software such as Rhinoceros 3D and Grasshopper. Increasing the architectural tool set and applying this to underutilised locally available sustainable materials will hopefully be a first step to build capacity in the construction section and in a position to apply this knowledge to the needs of those who need resilient, sustainable and adequate buildings.

Working in groups of 2 or 3, using the '*Rosa de Los Vientos*' as a base, groups will be asked to model the roof system in Rhinoceros 3D. Participants will then be asked to identify parameters in the design which could be used to develop the design further. These can be: applying different joint sizes; or length of members, etc. In groups an algorithm in grasshopper will be built and this will allow the roof system to adapt to new site parameters whilst ensuring durability, and give those building the design the relevant information.

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PROTOTIPO B: "ROSA DE LOS VIENTOS"

### What is required from the participants?

- Each participant must bring his/her computer.
- Rhinoceros 3D and Grasshopper must be installed previously on their computer.
- Basic knowledge on Rhinoceros 3D.

### Software

Throughout the course a range of software will be taught:

- Rhinoceros 3D (3D Modelling).
- Grasshopper (Parametric modelling).

### Number of participants

Max 12.

### Course lead

John Osmond Naylor.

### Design tutors

John Naylor and César Cheng.

Each will be responsible for 2 groups of 3 to 6 participants to oversee the design development and offer pastoral care.

### Dates

5 days: October 7<sup>th</sup> – 11<sup>th</sup> 2019.

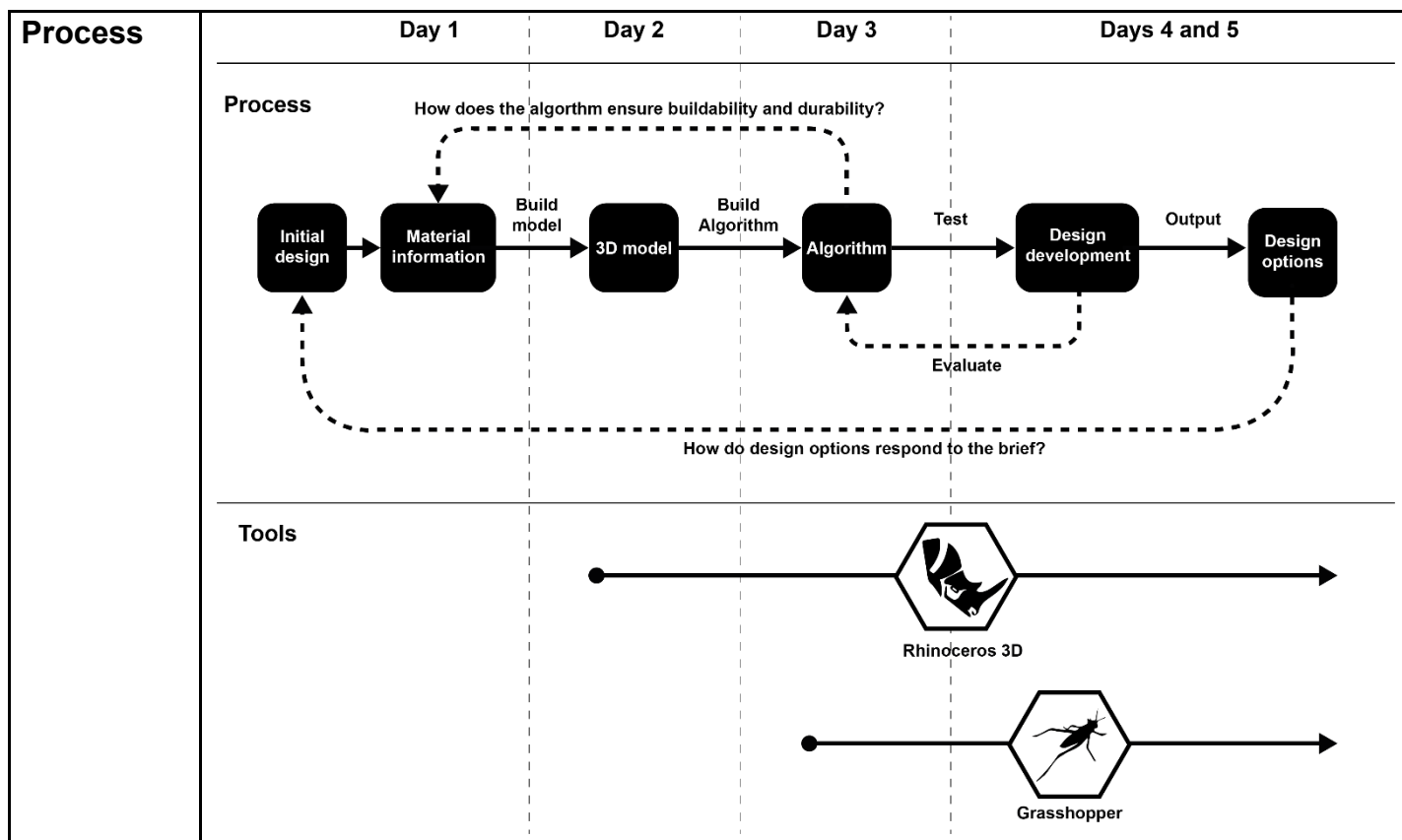
### Investment

\$650.<sup>00</sup>.

# 3D Design in Bamboo

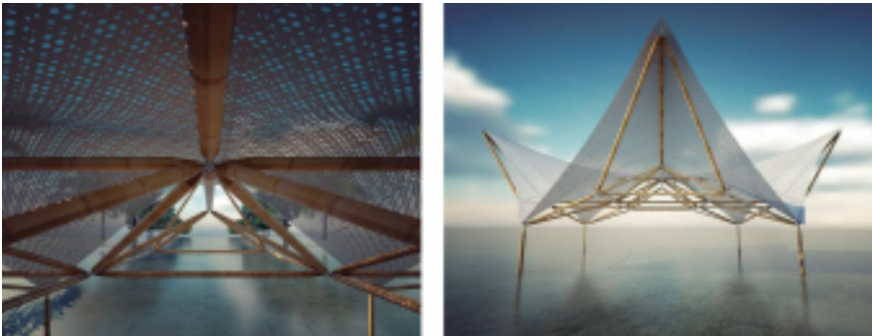
A five-day intensive course for experienced designers on using 3D modeling software for building with bamboo.

## Curriculum



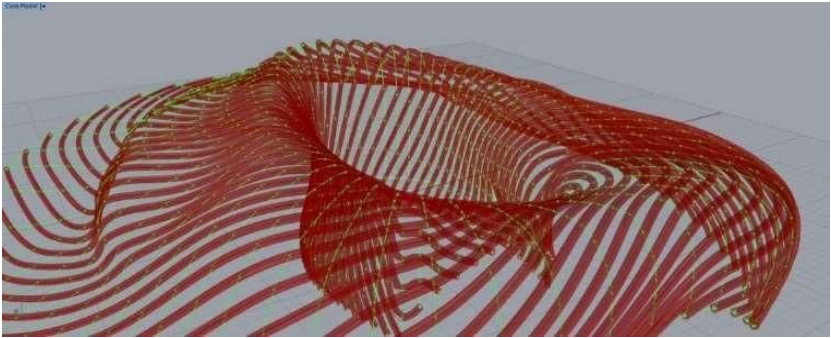
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Day		Title	Description
D A Y  1  .  0 7 - O C T	A M	<b>Bamboo in the built Environment and Model Making – Concept design</b>	<b>Stage 1 – Introduction</b> A brief introduction to the course.
			<b>Stage 2 - Bamboo the plant and construction material</b> This will be an introduction to the material of bamboo, learning the characteristics as both a plant and a construction material. Participants will learn cutting, treatments and which species' are often used for construction.
			<b>Stage 3 – Bamboo’s future role in Panama</b> Architect and former Vice Mayor of Panama City, Raisa Banfield will introduce the topic of Panama’s unique housing and ecotourism design challenges.
	P M	<b>Design introduction</b>	<b>Stage 4 - Principles of designing for bamboo to ensure durability</b>
			<b>Stage 5 – Introduce study model and identify parameters</b>  <ul style="list-style-type: none"> <li>• Sketch out: Participants will start by sketching out the ‘<i>Rosa de Los Vientos</i>’ design in 2D and through physical 3D models.</li> <li>• Understand parameters: Participants will then identify the parameters in the design which if amended will give different design options to the roof system.</li> <li>• Participants will then produce a physical model of 3 iterations in which the variable is changed. This will form the basis of the algorithm which will be produced in grasshopper on day 3.</li> </ul>
		<b>Group discussion</b>	Opening debate question by Nathan Gray and Anand Devarajan.

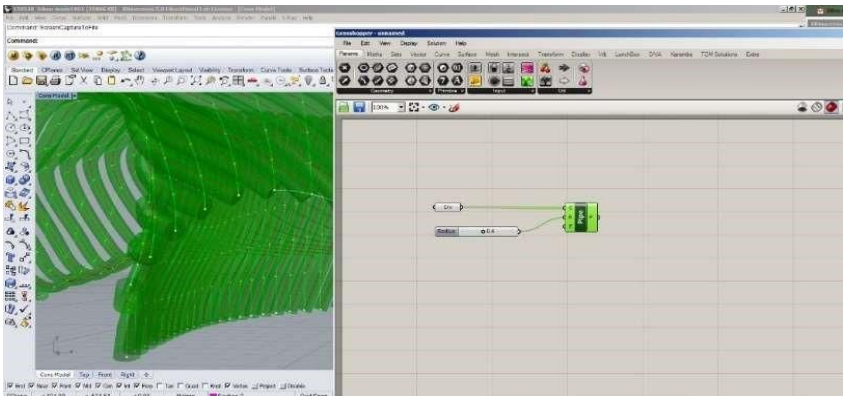
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<p>D A Y  2  .  0 8 - O C T</p>	<p>A M</p>	<p><b>Computer Modelling in Rhinoceros</b></p>	 <p>Starting in the morning, as a large group, we will go through a whole series of commands and learn Rhino from a position of no prior knowledge. We will all build the same element as a demonstration of how Rhino works. These 'commands' are broken into various chapters:</p> <ul style="list-style-type: none"> <li>● <b>Basics</b> Layers, Locking and Hiding, CPlane, Viewport properties, Set-camera, Selecting.</li> <li>● <b>Lines and Curves</b> Different ways of drawing Lines, Different ways of drawing Curves, Planar Curves, Osnap Commands, Degree varieties, Join and Explode, Fillet, Offset, Circle, Extend.</li> <li>● <b>Surfaces</b> Planar Srf, Loft, Sweep1, Sweep2, Ribbon, Patch, Network Srf, Project, Trim, Split, Directions, Curvature analysis, Offset srf, Drape, Heightfield, Zebra.</li> <li>● <b>Polysurfaces</b> Join and explode, Booleans, Mirror, Extrude Crv, Extrude Srf, Cap, Extract Srf, UnrollSrf, Smash.</li> <li>● <b>Mesh</b> Making a mesh, rebuilding mesh, Mesh to Nurbs.</li> <li>● <b>Transformations</b> Scale 1,2,3D, Array (Linear, Polar, On curve).</li> <li>● <b>Exporting</b> Make 2D, Exporting to AI, obj and stl formats.</li> </ul> <p>Following this presentation, each group will be asked to produce a Rhino model, of the '<i>Rosa de Los Vientos</i>' design referencing the previous day's physical models. There will be individual tutorials in order to oversee how this is completed.</p>
	<p>P M</p>	<p><b>Group discussion</b></p>	<p>What can architects do to tackle the perception of bamboo as the 'poor man's timber' in the context of Panama?</p>

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D A Y  3  .  0 9 - O C T	AM	<b>Presentation</b>	We will continue to work as groups and this time will be a chance to finalise Rhino models and consolidate the information from the day sessions so far as groups or as a class.
		<b>Grasshopper Introduction</b>	<p>Starting in the morning, as a large group, we will go through a whole series of commands and learn Grasshopper from a position of no prior knowledge. This introduction to Grasshopper. This will allow participants to understand:</p> <ul style="list-style-type: none"> <li>• The way to organise a workflow,</li> <li>• what an algorithm is,</li> <li>• grasshopper versions of many of the rhino commands to build the structure,</li> <li>• how additional 'plug-ins' can assist us.</li> </ul> 
	PM	<b>Component identification</b>	Participants will be asked to identify a parameter in the <i>'Rosa de Los Vientos'</i> roof system which will be taken forward and various options of this parameter can be created by creating an algorithm in Grasshopper.
		<b>Discussion and workflow organisation</b>	This is the most important aspect of understanding Grasshopper. To understand the project as a series of variables which all fit into a workflow. Here it is important to consider Grasshopper as a platform. One which uses open source 'plug-ins' and grasshopper as a medium to operate. There are many different 'plug-ins' for grasshopper and we will show the websites and questions participants should be asking in order to find the right plug in for their own questions.
		<b>Group discussion</b>	How can architects design with bamboo and ensure durability and resilience?

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D A Y  4  .  1 0 - O C T	A M	<b>Group discussion</b>	<p><b>Application of building system to solve the issue of affordable urban housing in Panama.</b></p> <p>Participants will be asked to look at the application of the building system in the context of housing in urban Panama by proposing a scale, programme and end user groups. Participants will be asked to propose how this building system can be a catalyst for socio-economic development using the series of group discussions as the basis for these propositions.</p>
	P M	<b>Developing the design</b>	<p>Using physical models, sketches, Rhinoceros and Grasshopper, this will be the opportunity to develop the design and communicate the buildability and incorporating all the skills learnt over the first 3 days. The medium of this communication will be developed in discussion with those in class. This will also involve the production of slides to present the project at the final jury.</p>
D A Y  5  .  1 1 - O C T	A M	<b>Developing the design</b>	<p>Continuation of the previous afternoon session.</p>
	P M	<b>Final jury</b>	<p>Here groups will present their projects to the whole group. This will also be a chance to ask questions to the group for feedback. All participants will discuss their projects and their workflow. Participants will be expected not to talk about this in concluding terms but as an open discussion about future possibilities, refinements and specialisations of their projects. This is hoped to continue the interest in the design process, the use of computational tools and the material of bamboo. The goal at this point is that design could be taken forward to technical design and the algorithms from the participants will allow the construction team and engineer to respond to new constraints and save time and money in adapting the design to suit new sites or material changes. Participants will also be required to present one slide which proposes an application of this building system to tackle the challenge of urban housing in Panama.</p>



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### Biographies



#### **John Osmond Naylor**

John is a registered UK architect at Grimshaw in London, and PhD researcher at Newcastle University. He completed his AA Diploma at the Architectural Association in 2013, winning the Holloway Prize, the Fosters Prize for Sustainable Infrastructure, and was featured in Dezeen top 10 bamboo projects 2014. John has worked at MAD, Beijing, rare Architects in Paris, and the Singapore University of Technology and Design, on complex projects in the UK, Singapore, Malaysia, China and Haiti.

He continues to lead the AA School's bamboo visiting research programme which attempts to reduce the gap between digital design tools and materials with natural variability such as bamboo. These have taken place in Haiti, Myanmar and now Bandung, Indonesia.

John's ongoing research looks at how architects can advance full-culm bamboo as a material to provide adequate and sustainable urban housing to achieve the

UN Sustainable Development Goal 11 by 2030.



#### **Anand Devarajan, Principal, Anand Devarajan Architects, Inc**

Anand Devarajan holds a Masters of Architecture from Yale University, where he was Frank Gehry's student while Gehry was the visiting Davenport Professor of Architecture in 1999. After joining Gehry Partners he has, since 2002, worked directly with Gehry, collaborating on the designs of a number of projects in the office. His international project experience includes a multitude of building types and scales ranging from museums and other cultural projects to commercial, residential and large-scale, mixed-use developments.

A co-founder of Geoversity Design, he continues as a Gehry Partners advisor while now heading up his own company of architects also based in Santa

Monica, California.



#### **Raisa Banfield, Ex-Vice Mayor of Panama City**

Raisa Banfield is the former Vice Mayor of the District of Panama. She is an architect by profession and has devoted many years to environmental protection. She feels the social economic development of Panama should be compatible with ecological sustainability. She was the Executive Director of CIAM (Center for Environmental Impact) from 2007 – 2010. She is the current President of Sustainable Panama (PASOS), an organization that she founded in 2010 to promote alternative solutions. She was co-founder of Alianza Pro-Ciudad (2010), Pro-Defense Committee of Camino de Cruces Park and other community organizations; and Coordinator and Producer of the television program Nuestro

Planeta (2010) a program on deals diverse environmental topics. She founded the architecture and design firm RGB S.A. (1994-2007). She holds a degree in Architecture from the University of Panama (1993). Now, Raisa is part of Geoversity Design.

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### **Jörg Stamm, Builder and Founding Partner, Geoversity Design**

Jörg Stamm is widely considered to be one of the most accomplished and skilled master builders in bamboo in the world. Following a career as a furniture maker and structural carpenter in his home country of Germany, he spent the last 25 years working with several of the great designers in bamboo, including the Colombian architect Simon Velez, the founders of the Green School in Bali, Indonesia and the designer Linda Garland, the founder of the Environmental Bamboo Foundation. Inspired by the pioneering work in tensile structures of Frei Otto and grounded in old world post and beam construction, he specializes in fusing European contemporary design and traditional bamboo carpentry.

Among Jörg's most well-known accomplishments are the design and building of covered bridge spans, up to 30 meters long, in Colombia and Bali; the iconic Simon Velez-designed pavilion for Colombia in the 2000 World Expo in Hanover, Germany; and the Orchid Pavilion at the McKee Botanical Garden in Vero Beach, Florida, the first officially recognized bamboo pavilion in USA.

Jörg has founded or helped start several bamboo-related companies and organized numerous introductory and advanced training programs in bamboo

construction in numerous countries in Asia, Latin America and Africa, including The Green School of Bali, Indonesia.



### **César Cheng, Architect at Suma**

César Cheng, architect specialized in urban design, design technologies and digital manufacturing. He received his master's degree from the Emergent Technologies and Design program, Architectural Association, UK. César has developed research in biomimetic design, alternative materials for construction, and advanced computational design. He has participated in international conferences and published research in academic journals in computer design. He has worked as a designer in international firms in Boston, New York, London, Berlin and Panama.

Recently he worked with the team of Suma architects in the development of the POT for Panama City, leading the computer design and data analytics team.

