Preface

The existing massive population migrations due to wars and forecasted migrations caused by climatic changes result in the need to design an architecture that provides a shelter under difficult conditions of survival. There appeared a humanitarian architecture [99] (2016) looking for building solutions that provide a potential for survival in disasters, also the potential for the development of the society after disasters. The humanitarian architecture creates the process of the balanced growth of the place and the people who live therein. The most advanced technologically and economically types of wooden structures, such as shell roof coverings, are worth adding to the humanitarian architecture. A special variety of such roof coverings are axially symmetrical coverings from solid wood, as discussed in this publication. Wood is the unique building material renewable in a way that it fosters the human environment, even reconstructing that environment, contaminated by the heavy industry products. While consuming carbon dioxide, it delivers oxygen to the atmosphere. Wooden domes collated and described in this publication are a favourable alternative to other building industry types.

The process of moving from post-beam systems up to reaching arches and dome forms, including wooden domes, lasted for centuries. Systems of a very favourable relationship of load capacity to the weight of a structure were developed by evolution. Despite many advantages, there are few records in the references on their subject. The existing information is fragmentary. Many solutions of dome structures vanished jointly with the people who built them. It is the intent of the author to propagate the knowledge of economic and eco-friendly wooden dome structures. For the further development of wooden structures, among others, domes, the author compiled the most urgent topics of theoretic research studies and analyses.

The form of a dome has a minimum outside surface in relation to that being covered. This results in a lower airflow resistance, owing to which domes are more resistant to the interference of wind and climatic impacts. The minimum outside surface limits losses of heat, increases energy savings, and reduces heating costs. The centre of gravity located quite low brings about that they are more stable in the situation of an earthquake. The publication aggregates historical examples and discusses such shaping of domes that allows to build facilities adapted to the recently occurring climatic phenomena.

The monograph discusses 36 structural solutions of historical domes and compares them to nine examples of the most eminent accomplishments of domes made from glued laminated timber. The structure of some forgotten domes was reconstructed on the basis of the available information remainders. The missing data were supplemented on wooden models or computer visualizations so as to present the most advanced, technologically and economically, types of historical wooden structures. The reconstructed file is all the more precious because it presents the systems characteristic of wooden structures only, perfected over centuries by talented builders. Their characteristic feature is that they are geometrically invariable, being safe in use at the same time. The adaptation of the construction to the dome shape, using the properties of wood, followed over centuries, which resulted in the development of reliable systems. The structural solutions consisting in the multiple prestressing of load-carrying elements brought about the development of systems having a high load capacity at a minor weight of the wood applied, including that of common quality.

The comparison of the accomplishments of a large cubic capacity from glued laminated timber and domes from non-glued laminated timber allows to notice a lower consumption of materials as converted per unit of the projection area for historical domes.

The paper shows that many among historical solutions of dome structures from non-glued laminated timber have had, until this day, an economic, eco-friendly and technological justification. They should continue to be developed based on the improvement of systems characteristic of wood.

In the present-day edition of this monograph, the historical part has been supplemented with new examples of dome structures of facilities, built until the middle of the twentieth century. They have been compared against the largest domes from glued laminated timber built in 1977–2004. The description of the research has been broadened by the testing of wood properties.

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I yield thanks to the attention of the Director of the Faculty of Wood Construction Engineering, Miyazaki Prefectural Wood Utilization Research Center, Dr. Yutaka Iimura, to the Company's Management Board for making available the drawings of large-cubature space domes from glued laminated timber built in Japan. I thank all the team for the friendly welcome at the Company's seat.

I sincerely thank the readers who have become familiar with my book entitled 'Shaping the Solid Wood Domes' for their favourable feedback. It has motivated me to work on the second edition, supplemented and broadened, entitled 'Wooden Domes'.

I yield my respectful thanks to all those who contributed to the publication of this book.

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