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Wooden Structures and Smart Structures: Modularity in *Yingzao Fashi* and Fluxus Prefab System

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木构与智构——营造法式的模件体系与激浪派预制系统

Wooden Structures and Smart Structures: Modularity in *Yingzao Fashi* and Fluxus Prefab System

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1/ Comparison of Documentation		
	Wooden Structures: The <i>Yingzao Fashi</i> Modular System	Smart Structures: The Fluxus Prefab System
Title	<i>Yingzao Fashi</i>	Maciunas Prefabricated Building System
Year	1103	1965
Type	Technical manual for building methods and official standards.	Pamphlet on standards and proposal of prefabricated building system.
Objectives	<ol style="list-style-type: none"> 1. Compiled during the Song Dynasty as commissioned by the central government, the book was to curb corruption in society (a side effect of the thriving architecture industry resulting from the increase in housing demand); to reduce the waste of materials and capital, and to prevent local governments from committing corruption during construction management. 2. To provide government officials in charge of public construction projects with an authoritative guide and standardized professional knowledge of precise construction process and highly effective budget management. 3. To provide craftsmen under the supervision of government officials with guidance. 4. To provide practical knowledge of architecture and to make it accessible to the whole of society. 	<ol style="list-style-type: none"> 1. Proposed by a visionary architect and social planner George Maciunas, the building system is to illustrate the universal objectives: value, economy and efficiency (explained in his critique on art and architecture, 1964). 2. To solve the problem of short supply of housing, and to enhance urban efficiency and social welfare. Through standardization, modularization, and massive manufacture of prefab system, wastage of energy, materials, time and costs can be reduced. 3. To provide government with a highly innovative and integrative approach to "efficiency" in the sense of making a wealth of use-values available to the whole sectors of society. 4. To promote building systems that can be built by unskilled workers, and the architectural knowledge that can be grasped by not only professionals but by all peoples.
Impact of Publication	A grammar book that decodes ancient Chinese architecture	A manifesto that is being decoded; a modern successor of <i>Yingzao Fashi</i>

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Yingzao Fashi (1103) is the oldest complete technical manual on building methods and official standards found in China, while *Fluxus Prefab System* (1965) is on standards and proposal of prefabricated building system. Both treatises share fundamental unity in setting a universal framework where social, economic and sustainability strategies come into play, and offering a generic construction system that lends itself equally to all types of architecture at all scales.

Compiled during the Song Dynasty as commissioned by the central government, the general purpose of *Yingzao Fashi* was to curb corruption in society (a side effect of the thriving architecture industry resulting from the increase in housing demand): to reduce the waste of materials and capital, and to prevent local governments from committing corruption during construction management.

Likewise, the invention of Fluxus Prefab System aims to solve the problem of short supply of housing, and to enhance urban efficiency and social welfare through a system of standardization, modularization, and mass-production, thereby reducing wastage of energy, materials, time and costs.

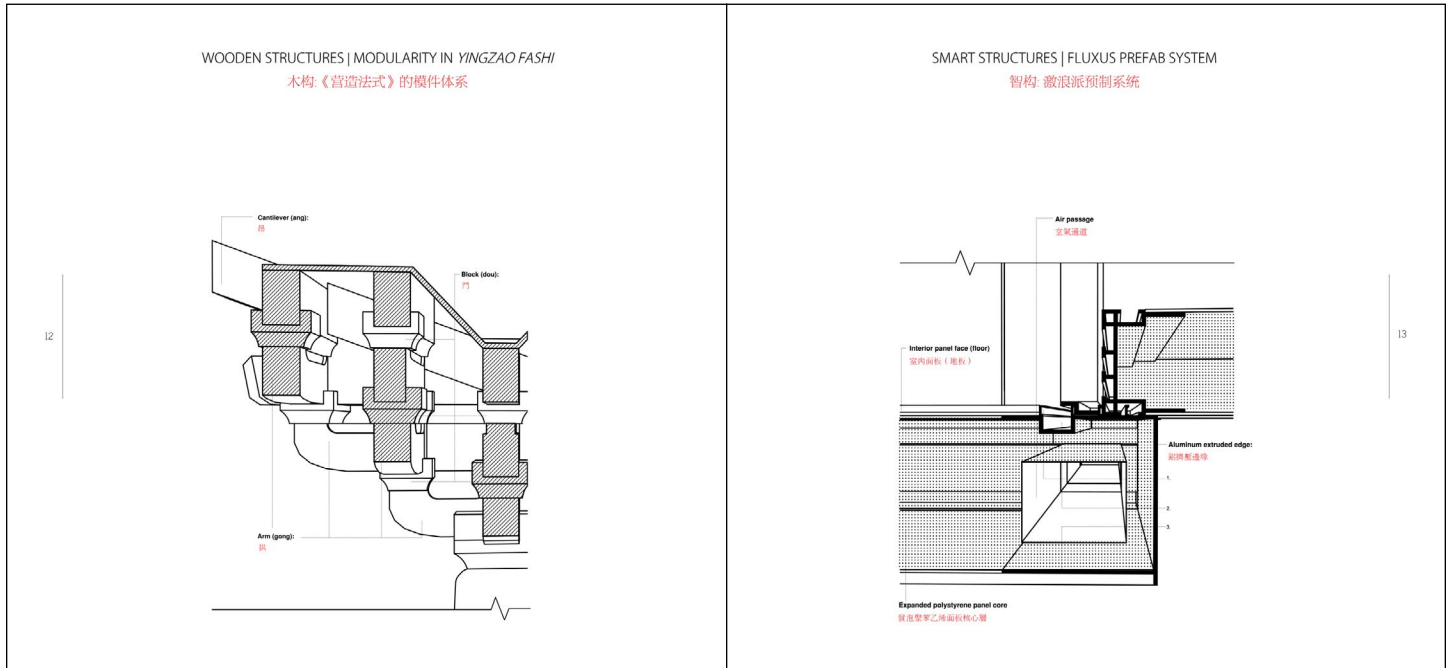
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Yingzao Fashi sets standards of construction methods, work quota and materials for an integrated building system that consists of a limited number of components – block (*dou*), arm (*gong*) and cantilever (*ang*), etc. The adaptive system is designated to be deployed throughout the entire empire of all climatic and seismic and cultural conditions.

In Fluxus Prefab System, the concise design with minimum number of components is achieved by building panels made of four basic parts: interior surfaces, exterior surfaces, core and edge, containing all functions of structure, enclosure, and service. The universality of Fluxus Prefab System is reflected on the way internal space to be modified after initial construction and modules to be restructured and expanded so as to create clusters, communities and cities. The system provides an adaptive urban model for need-based growth suitable in various natural and social contexts.

The construction process of Chinese wooden structures is based on prefabrication, which is favored for its construction efficiency and ability to be put into mass production. The smart structures of Fluxus Prefab System, embedded with logistic networks, recycling flows, and efficient use of resources through a network of intercommunicating passages built into the hollow structural components, can be understood as an advanced version of traditional prefabricated wooden structures.

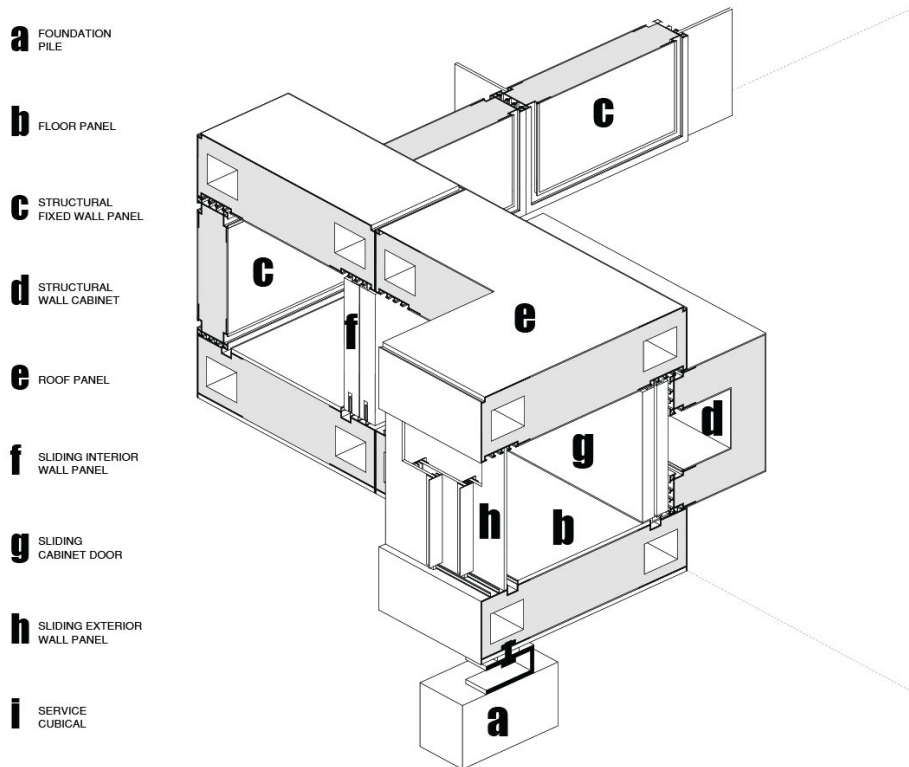
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Fluxus Prefab System diagram: Isometric cross section of components

The following are some of the advantages of the Fluxus Prefab System over conventional methods being used at the time of its development:

1. The time required for two men to construct a typical home using this method, including fixtures, should be no more than four days.
2. Due to the use of ceramics, plastics, and nonferrous metals only, the structure is immune to: water damage, discoloration, corrosion, rotting, warping, and termites. Maintenance costs are minimal.
3. All conduits for centralized air-conditioning and heating, as well as electrical wiring and plumbing, are provided by the mere joining and locking of the panels.
4. Plastic as a building material provides superior insulation and a vapor barrier.
5. By using sliding panels that can be attached to tracks in the panel edging, the layout of interior space, as well as the number and sizes of rooms, can be altered at will.
6. It lends itself equally to residential housing, office buildings, schools, cultural centers and factories, etc.

Ecological responsibility and awareness, energy efficiency and sustainability, all have become pervasive and often mandated at every level of society today. Buildings will continue to be more responsive to the natural environment in terms of material and energy resources used to build, maintain, and ultimately dispose of or reuse them. The intelligence of the Fluxus Prefab System also can be seen in the utilization of sustainable materials. As an improvement of prefabricated concrete building, Fluxus Prefab System uses plastics by taking advantage of their high strength-to-weight ratio, great design flexibility, insulating properties, and recyclability, which take into account all the environmental, economic, and social impacts in prefabricated building design.