Artificial Intelligence

人工智能：概念、方法和数据

NextGen DigiTech

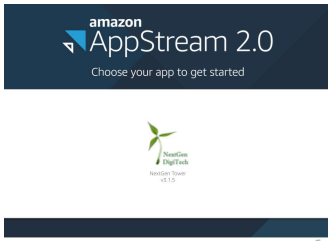
NextGen Tower

by NextGen DigiTech V.O.F.

Tower Automatic Design & Optimization Software

塔筒自动设计&优化软件

NextGen Tower, a dynamic & robust engineering software by NextGen DigiTech V.O.F. is developed fully in house to design, analyze and optimize tubular steel wind towers for the both soft-stiff and soft-soft categories. The primary motivation for developing 'NextGen Tower' is the substantial tower mass savings and cost optimization for leading industry partners.



NextGen DigiTech has performed substantial feasibility study and explored all the modern technologies such as big data, data science, cloud based networking, artificial intelligence and machine learning to make the software robust in collaboration with the University of Southern Denmark, University of Groningen and expert technical consultants from industries.

Functions

The software have the following functionalities:

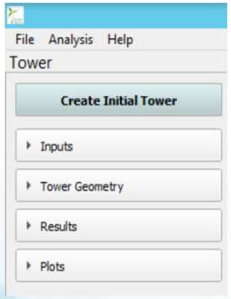
a. Most plausible initial tower design based on turbine operational data

b. Optimized tower design based on given loads

c. Frequency calculation

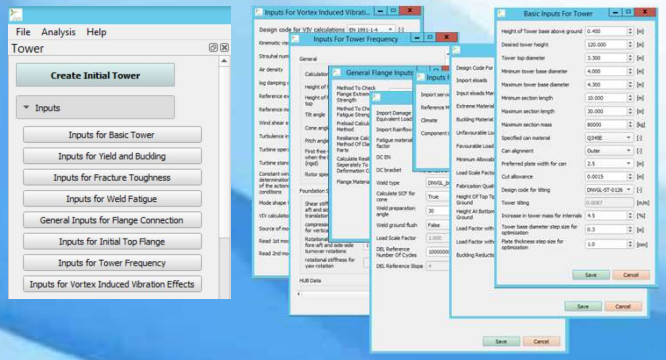
d. Automatic reporting for certification

e. Automatic tower drawing



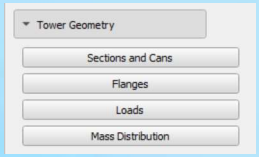
Input Module

In the input module, the basic requirements and design parameters can be provided. Choosing the design standard and importing the loads are also available.



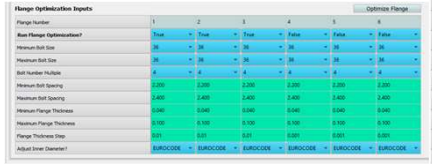
Modeling Module

In the modeling module, the software will automatically choose the right initial tower design based on its own database. The model can be manually modified according to client requirements.



Optimization Module

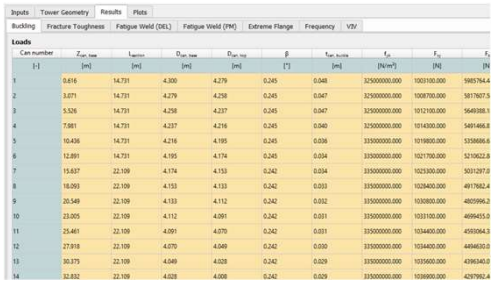
The software optimization module includes advanced algorithm & calculations developed by the NextGen DigiTech team. It can be manually set to optimize certain 'can' and 'flange', then the software will operate automation & iteration to optimize. For the 'flange' optimization, the software will list ten optimized schemes. Users can decide which one to adopt; this is an unique feature of the software.



Result Module

Necessary calculations can be done using the software such as:

- Strength against extreme load
- Fracture toughness
- Strength against fatigue load(DEL)
- Strength against fatigue load(PM)
- Flange connection
- Frequency
- VIV



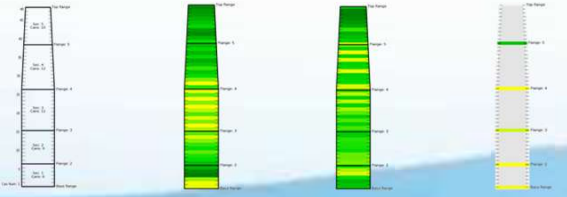
Certification reports containing these results can be automatically produced using the software and customers can customize the report format according to their specifications.

Plot Module

The tower schematic and some margins for extreme and fatigue are listed in the plot module. Users can see the safety margin of tower very intuitively.

- Buckling strength margin
- Fracture toughness
- Fatigue strength margin(DEL)
- Fatigue strength margin(PM)
- Flange connection (extreme) margin
- Frequency mode shape

Tower schematic | Buckling safety margin | Fatigue safety margin | Flange safety margin



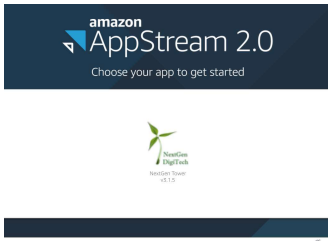
Time Consuming Comparison

	Manual	NextGen Tower
	[h]	[h]
Input Loads	8	0.2
Create Initial Tower Model	4	0.1
Model Revise	8	1
Tower shape Optimization	16	0.5
Can Thickness Optimization	16	0.5
Flange Optimization	16	0.2
Strength Calculations	8	0.1
Reporting	64	2
Total	140	4.6

Advantages

- Intelligent and easy to operate
- Automatic operation to reduce the error rate
- Automatic iteration and optimization can greatly reduce tower weight
- Automatic reporting and tower drawing creation improve work efficiency

NextGen Tower是由NextGen DigiTech V.O.F团队完全自主开发的一款工程软件，主要用于设计和优化钢制管状塔架（包括普通钢塔和柔塔）。NextGen Tower软件开发的目的是为用户降低塔架设计重量，以达到节省成本的目标。

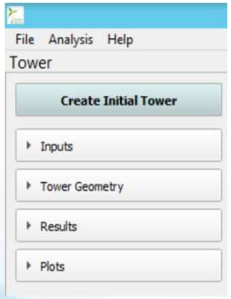


NextGen DigiTech与南丹麦大学以及各行业的专家技术顾问合作，进行了大量的可行性研究，并在现代技术，如大数据、数据科学、云端网络工程、人工智能和机器学习方面进行了探索，使软件更加强大。

软件功能

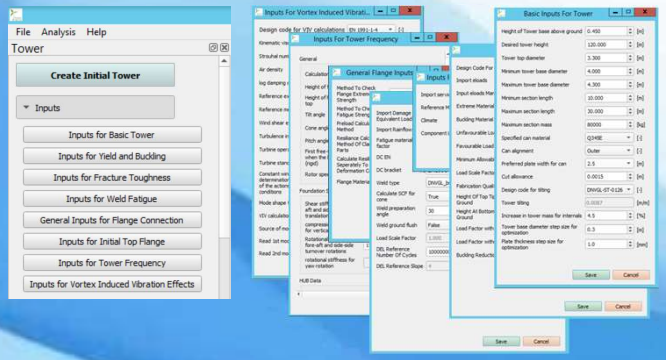
该软件具有以下功能：

a. 基于机组运行数据，建立最合理的初始塔架模型
b. 基于给定载荷的塔架优化设计
c. 频率计算
d. 自动出认证报告
e. 自动出图



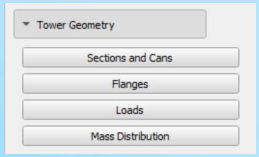
输入模块

在输入模块中，可以输入基本设计要求和设计参数，也可以进行设计标准的选择和载荷的导入。



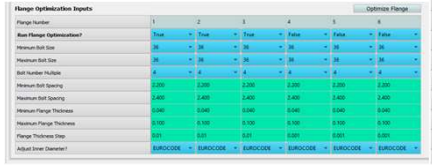
建模模块

在建模模块中，软件将基于自带的模型数据库自动选择最优的初始设计塔架模型，用户也可以根据自己的要求对该模型进行手动修改。



优化模块

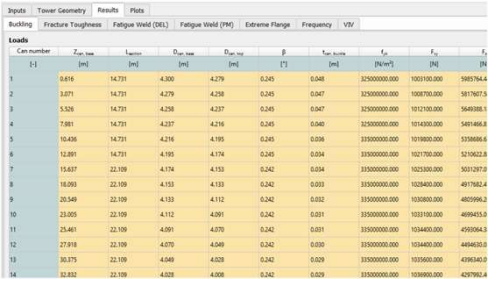
软件优化模块内置NextGen DigiTech团队开发的先进算法，用户可以手动设置对特定的筒节和法兰进行优化，软件会自动进行迭代优化运算。软件会给出十种法兰优化方案，用户可自主决定选用哪种方案。此优化功能是该软件独有的。



结果模块

软件可以进行如下的校核计算：

- 极限强度和屈曲
- 断裂韧性
- 等效疲劳损伤
- 疲劳损伤（雨流计数法统计的载荷）
- 法兰连接
- 频率
- 涡激振动

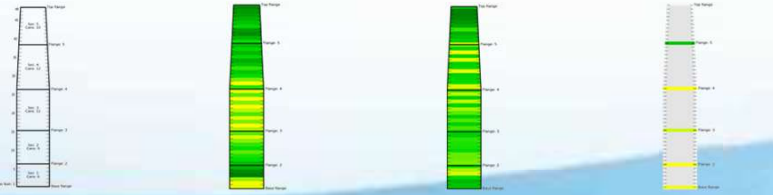


软件可以自动编制包含上述计算结果的认证计算报告，也可以根据用户要求定制报告格式。

绘图模块

在绘图模块中，列出了塔架示意图、极限和疲劳的安全裕度，用户可以非常直观地看到塔架的安全余量。（用不同颜色代表安全裕度大小）

塔架示意图　屈曲安全裕度　疲劳安全裕度　法兰安全裕度



耗时对比

	人工	NextGen Tower
	[h]	[h]
载荷输入	8	0.2
设计初始塔架模型	4	0.1
模型修改	8	1
形状优化	16	0.5
筒节壁厚优化	16	0.5
法兰优化	16	0.2
强度计算	8	0.1
编制报告	64	2
合计	140	4.6

优势

- 智能化软件，操作简单
- 自动运算，降低出错率
- 自动迭代优化可以大幅降低塔架设计重量
- 自动出图和认证报告，可以大幅节省时间，提高工作效率