

Keio univ. Ustar Computational Program FRONE Edition

# UstarSOL

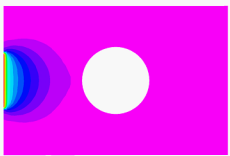
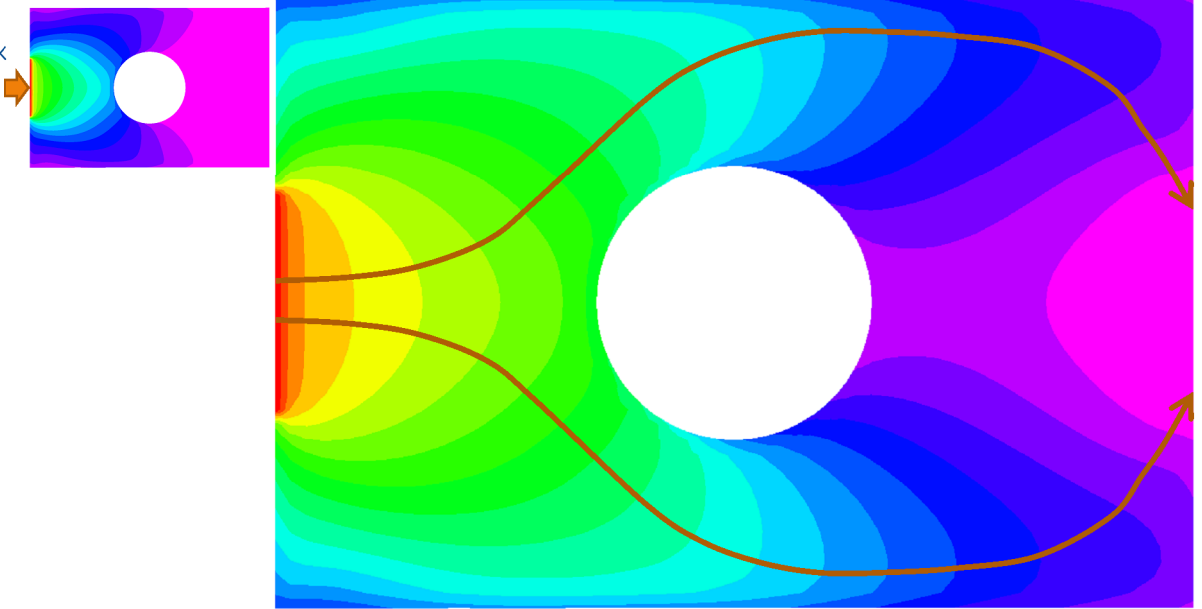
## UstarSOL

Compute Ustar Index & Scaled Ustar

Platform

OS) Windows 7,8,8.1  
64/32bit

MEM) 4GB+  
CPU) Core-i3+



### Ustar is...)

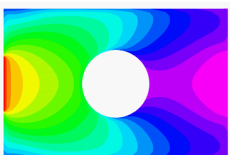
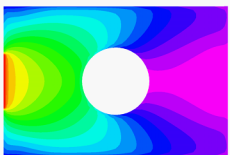
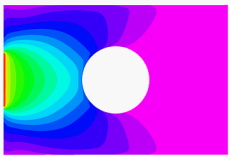
Ustar(U\*) computational program FRONE edition is the revolutionary new approach for understanding load path inside of any body based on Ustar computational scheme invented by Dr. Kunihiro Takahashi, emeritus professor at Keio University.

The conventional method to evaluate the integrity of structure is just focused on strength and stability, while not for evaluation of load path which is the essential function of structure.

Ustar approach is focused onto the difference of distribution of strain energy inside structure, and compute the overall distribution of load and its flow and visualize. With Ustar, one can see the load flow inside structure directly, and understand which feature of structure supports and where is the primal load path.

Ustar computational program is based on the Inspection Load Method and calculate Ustar index by deformation results. Since Ustar computation requires highly intensive

calculation, the inspection load method. Results are output as CSV for convenience.



Load flow on Time Transient

Conventional FEM Analysis

Strain Energy U

For each C in Model..

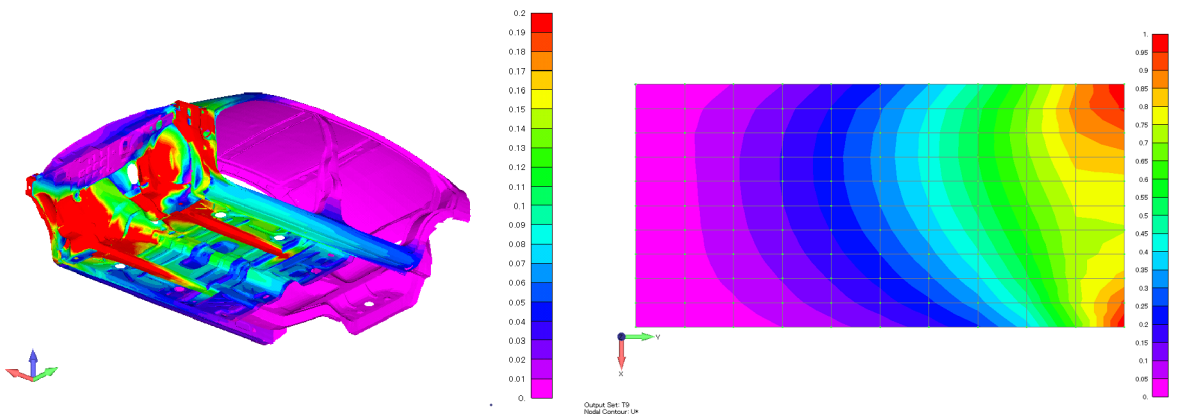
Strain Energy U'

U\* at Point C is

$$U^*_{@C} = 1 - \left(\frac{U'}{U}\right)^{-1}$$

A : Loading Point  
B : Constrained Point  
C : Any Position in the model

Ustar is the only method for Load Flow



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## General)

The operation is simply specify following required files through GUI  
 PCH : NASTRAN output file for Inspection Load Method  
 DC : Deformation of a model  
 PA : Nodal reaction forces

## Ustar Computation)

Ustar computation is a revolutionary new method using entire structural features. The conventional FEM computation divide a model into small pieces (mesh) and evaluate structural effect induced by entire model to each node.

In contrast, Ustar computation evaluate effect of each node to the rest of model.

For this, Ustar computation requires intensive calculation of influences from each degree of freedom to the entire model.

Ustar computation requires calculation of strain energy of entire model with respect to each dof of model. This means that Ustar computation requires reforming the entire mathematical model for each dof. Usually, the major time consumption of FEM is the process of building mathematrix. Although the Ustar index gives a new insight of structural integrity, the computation must take extremely long time in principle.

## The Inspection Load Method)

The Inspection Load Method<sup>\*1)</sup> is the breakthrough to reduce time costs to the level of conventional FEM analyses. Inspection Load Method is needed to form the mathematrix at just one time, then perform linear static analyses for number of DOFs.

Once the mathematrix is formed, solution of linear static analysis is done extremely rapid.

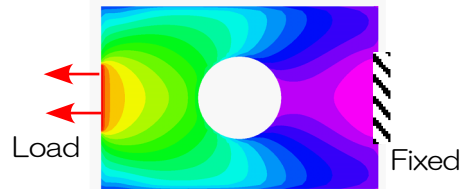
The results from Inspection Load Method are transferred to the main Ustar computation program.

## The Ustar Index)

Ustar index is normalized 0.0 to 1.0 reflects the effectiveness of structural stability if the node is constrained, and also load flow gradient in the structure. The higher normalized value means higher effectiveness and lower the lower.

This technology is comprehensively utilized by many of Automotive manufacturers to assure structural integrity for more than 10 years.

The program is extended

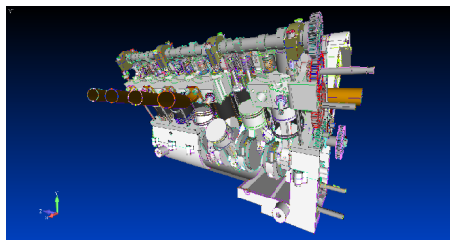


Red : U\*=1.0 ->High stability if fixed  
 Purple: U\*=0.0 ->Low stability even if fixed

applicability of U\* to the dynamic analysis.

## Functions)

The program can be used to compute Ustar index very effectively.



Ustar index is output as Ustar value for each node in simple CSV format.

Supports multi-point loads.

In addition to static solution, the program can consider inertial loads when dynamic analysis.

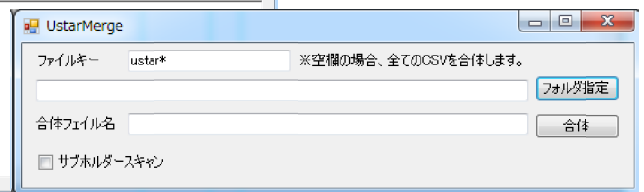
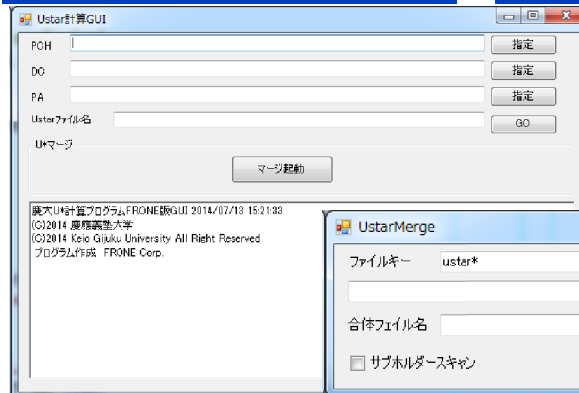
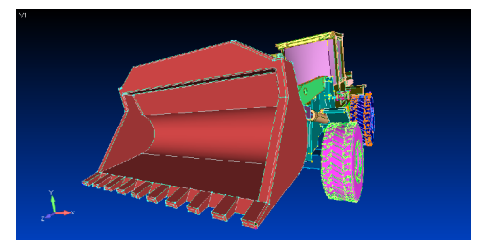
Can combine multiple results in one index distribution.

## Applications)

- \* Safety and Integrity
  - Structural safety and durability assessment of vehicles such as automobiles, trains, or aircraft..
- \* Safety of Sports Equipments
- \* Durability of damaged structure
- \* Propagation of vibration induced by such as motors, wing flutters..
- \* Reliability
  - Reliability of high-rize buildings or construction machineries
- \* Load path evaluation of large scale structures such as ships
- \* Stabilities

## Services)

The program is basically using NASTRAN data format for the input. We please to make offer to build any systems suitable for your own solution environment.



\*1) The Inspection Load Method implemented in "Keio Univ. Ustar Computation Program FRONE Edition" is Patents of Keio university

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