Prometech Simulation Conference 2014 -Summary of Lecture-

Invited Lecture

We think about the future Japan's Monodzukuri
-New aspect of Manufacturing enabled by Information Technology-

Kazuo Iwano
Principal Fellow
Center for Research and Development Strategy, Japan Science and Technology Agency

＜Summary＞
First, we cover progress of Information technology including Cloud Computing and Big Data. We, then, consider its implications of Manufacturing industry.

Presentation

The Computational Reality
-Prometech' s vision and strategy for next-generation simulation technologies-

Toshimitsu Fujisawa
CEO
Prometech Software,Inc.

＜Summary＞
Prometech Software has continued to challenge for the practical application of the MPS method together with visionary users of Japanese industry. The range of application of the MPS method has spread out rapidly from automotive, chemical and material fields to the food or pharmaceutical sectors. In this session, we will present the examples of industrial application of the MPS method, and discuss directions of technology development in the future. In addition, we will introduce a new initiative for co-creation of the Particleworks, in which we intend to collaborate strongly with users, researchers and our business partners.

Special Lecture

Manufabturing of the world and CAE from the view point of multibody dynamics

Professor, Department of Mechanical Engineering, Kyung Hee University
Board member and founder of FunctionBay, Inc. Jinwhan Choi

＜Summary＞
As of today, for reliable designing of various mechanical products composed of sophisticated subsystems and parts, it has got inevitable to investigate all possible interactions between subsystems and parts during development stage utilizing CAE rather than time-consuming and high-cost physical experiments. For satisfying this request, analysis with multi body dynamics is widely preferred on that it can give total solutions for whole system as well as each part itself. Moreover, various connection to other fields of physics may get easily ready without a burden of special works.

Keynote Speech

Frontier of computer simulation using particle methods

Seiichi KOSHIZUKA
Professer
Department of Systems Innovation, Graduate School of Engineering
The University of Tokyo

＜Summary＞
Particle methods are simulation techniques to solve continuum mechanics without meshes, so that complex motion of free surfaces and interfaces is easily analyzed. In Japan, commercial codes have been developed and applications to industry are progressing as well as the most advanced studies on the particle methods are continuously carried out. In this lecture, frontier studies on computer simulation using the particle methods in Japan and foreign countries are introduced.

Particleworks Lecture A1

Numerical Analysis of Spray Water Flow in Steel Making Process

Norimasa Yamasaki
Head of Dept.
Mechanical Engineering Div. Plant Engineering and Facility Management Center,
Nippon Steel & Sumitomo Metal Corporation

＜Summary＞
Spray cooling processes are widely used in steel making process. It's important to cool high-temperature objects uniformly and with desired cooling rates. A large volume of water is commonly used, so to know the flow pattern of spray water is necessary. To simulate these free surface flows, MPS method has been applied. The accuracy of the numerical model has been verified by the water model experiment by using evaluation indexes such as volume of water, water density, and impingement pressure etc.

Particleworks Lecture A2

Debris flow simulation on the debris flow breaker by Particleworks

Ikeda Hajime
Subsection Chief
KITAC CORPORATION

＜Summary＞
A debris flow breaker is a gridiron-shaped screen placed in a riverbed.
It has the ability to separate the solid and liquid phases of the debris flow, which can reduce tractive force. In this study, we aimed to determine the optimal specifications for debris flow breakers by reproducing the flow-down process of debris that flows into a debris flow breaker. Moving distance of the debris flows were able to obtain results close to Experiments. Analysis method of this paper was shown to have applicability to the reproduce of the debris flow.

Particleworks Lecture A3

Application examples of Particleworks for development of Transmission and Transfer Case for Automobiles

Naohiro Fujita
Information Technology System Sec. Information Management Dept.
UNIVANCE CORPORATION

＜Summary＞
Parts in Transmissions and Transfer Cases need lubrication oil to maintain performances. The lubrication oil needs to be splashed by gears or a chain on each part as much amount as needed. However the movement of splashed oil is complicated and difficult to observe by sight. It is also difficult to predict the amount of oil supplied on each part. This presentation introduces how the oil movement was visualized by using Particleworks.

Introduction of Technical

Application of Simple Coupling Technique using Particleworks & LS-DYNA for Product Development

Sunao Tokura
Technical Adviser,Prometech Software,Inc.
President,Tokura Simulation Research Corporation

＜Summary＞
Estimation of strength of structure in fluid structure interaction problem is frequently needed for product design and development. Incompressible flow solver Particleworks is considered as suitable software for this kind of problems since most of fluid problems relating to product design and development are regarded as incompressible. In this presentation, an efficient analysis technique using simple coupling procedure of Particleworks and explicit FEM software LS-DYNA is introduced.

Particleworks Lecture A4

Activities for Particle Method Utilization in DENSO

Tsuyoshi Hattori
Project Assistant Manager
Digital Engineering Dept., Engineering R&D center,
DENSO CORPORATION

＜Summary＞
DENSO is promoting the utilization of Particleworks. Last year we established the simulation technology of motor cooling oil flow. Although we are trying to apply for other products or themes to expand the Particle method utilization, it is often the case that we cannot successfully utilize Particleworks in product development or design due to the lack of physical models in Particleworks. In this session we will explain our utilization examples, and we would like to request Prometech to enhance the basic function and the system.

Particleworks Lecture B1

Prediction of an optimal condition for large-scale Euglena (microalgae) culture using computational fluid dynamics analysis

Kengo Suzuki
Director,General Manager R&D Department
euglena Co., Ltd

＜Summary＞
Microalgae which grow by photosynthesis in water are focused as attractive unused biomass recently. However, it is difficult to investigate every condition to culture some microalgae in large-scale due to time and cost. On the other hand, computational fluid dynamics (CFD) analysis enable us to predict an optimal condition without actual experiments. In this presentation, some results regarding as an application possibility of CFD analysis to microalgae culture will be discussed.

Particleworks Lecture B2

Numerical visualization of physical properties of food during swallowing
with 3-dimentinal swallowing simulator “Swallow Vision®”

Tetsu Kamiya
Manager of Ingredient Development Group
Food Technology Research Laboratories R&D Division
Meiji Co., Ltd.

＜Summary＞
Aging advances in many developed countries. The cause of unexpected death of elderly people is mainly aspiration-related pneumonia. To improve the quality of life and extend the healthy lifetimes for elderly people, there is an emphatic need for research and development on the safety of food and the mechanisms of swallowing disorders. A human swallowing action was simulated using the three-dimensional swallowing simulator “Swallow Vision®”. “Swallow Vision®” could be used to examine several physical properties related to the liquid bolus configuration, including the velocity, shear rate, viscosity and force on epiglottis. In this presentation, I will explain the future vision of swallowing through the “Swallow Vision®”.

Particleworks Lecture B3

Flow Analysis in compression molding with high viscosity resin by Particleworks
-Discussion on the effect of analysis parameters-

Yoh-ichi Shiina
Manager
SEKISUI Engineering Co., Ltd.

＜Summary＞
There are parameters for computational stability in addition to several parameters regarding time step. There are few reports discussing the pressure relaxation coefficient. I would like to show performance when suitable parameter is set in compression molding of resin with high viscosity in the paste form.

Particleworks Lecture B4

Prediction of polymer pellets compression behavior by DEM and plasticization analysis by DEM-MPS interaction method

Hideki Tomiyama
Manager
The Japan Steel Works, LTD. Hiroshima Research Laboratory

＜Summary＞
We modeled DEM for plastic pellets and MPS for molten polymer in order to analyze the extrusion polymer processing. Further we try plasticization behavior by a DEM-MPS interacted calculation technique.
Recently we have problem that DEM cannot show an elastic behavior of solid-state polymer, so we try to modify DEM with elastic calculation models.
In this presentation, I’ll talk about details modified DEM models and their quantitative performance.

Particleworks Lecture B5

Process design for bio-oil production utilizing Particleworks

Sou Hosokai
Researcher
National Institute of Advanced Industrial Science and Technology

＜Summary＞
A kind of screw type process is employed for a bio-oil production with biomass fast pyrolysis. Heat media particles are conveyed and contact with biomass in this process. It is therefore important to obtain the behavior of the biomass and heat media particles for designing and optimization of the process. Discrete Element Model (DEM) in Particleworks is applied for analyses of the particles behavior. Some of the results will be presented.

GPU Computing Workshop for Advanced Manufacturing -Summary of Lecture-

GPU Keynote Speech

GPU virtualization software for enabling a simple programming of multi GPUs

Tetsu Narumi
Professor
Department of Communication Engineering and Informatics,
The University of Electro-Communications

＜Summary＞
Even a beginner of parallel programming can start GPGPU with CUDA language. Simulations with tens of GPUs would shorten the time to search optimal parameters, but one usually needs parallel programming with MPI. Our DS-CUDA enables us to use multiple GPUs without OpenMP or MPI. Simulations with 1,024 GPUs of TSUBAME GPU cluster in TITECH will be shown in the talk.

NVIDIA Special

GPU computing becomes familiar by CUDA6/OpenACC

Akira Naruse
Senior Developer Technology Engineer
NVIDIA

＜Summary＞
GPU technologies, which can accelerate scientific simulations more easily,have been required as the use of GPU computing spreads.
In this session, I introduce powerful new features in CUDA 6 for GPU computing,and also introduce case examples using OpenACC which allows us to utilize GPU resources by existing codes with directives.

NVIDIA GRID delivers rich graphics anytime, anywhere and on any device

Masaki Sawai
Solution Architect, Enterprise Solution Product Group
NVIDIA

＜Summary＞
Learn how to deploy high-performance remote graphics applications using NVIDIA GRID Virtual GPU. This session will include an architectural overview of GRID Virtual GPU, which provides true hardware virtualization and sharing of the GPU between multiple virtual machines on the most common hypervisors, and the technology behind GPUs in virtual environments.

GPU Lecture 1

3-D digital imaging by X-ray CT and voxel FEM analysis by massively-parallel computation

Gakuji Nagai
Associate Prof.
Dept. of Mechanical Eng., Faculty of Eng.,
GIFU UNIVERSITY

＜Summary＞
In recent days, only way to accelerate computations is using massively-parallel machines such as GPU and MPI-cluster. Non-structural FEM meshing for arbitral geometric shapes, which is the most advantages among other methods, has been taking less advantages. Because of it, we have been considering that voxel FEM of uniform cubic FE mesh using 3-D images captured by X-ray CT is a candidate for the massively-parallel computations. In this presentation, we will talk about how to develop massively parallel algorithms using GPU and MPI for the voxel FEM analysis.

GPU Lecture 2

Comparisons among Intel x86 CPU, Fujitsu Sparc64 CPU, Intel Xeon Phi, GPU computing through implementations of simulation codes for particle method

Kohei Murotani
Assistant professor
Department of Systems Innovations, School of Engineering,
The University of Tokyo

＜Summary＞
When I was porting an explicit MPS code developed for Intel x86 CPU to Fujitsu Sparc64 CPU, Intel Xeon Phi, GPU, the effective improved points are respectively described for each architecture. The current performances archived in each architecture are also shown.

GPU Lecture 3

Tutorial Thrust

Shinya Kitaoka
Senior Engineer
Product Development Department
Prometech Software, Inc.

＜Summary＞
This tutorial session introduces Thrust library which is included in CUDA Toolkit. The library is a parallel algorithms library which resembles the C++ Standard Template Library (STL); It supports not only CUDA but also TBB and OpenMP. I give details of fundamental techniques for using the Library. I also show how to implement a liner systems solver of linear equations by QR decomposition using Givens rotation. Furthermore, I compare its performances, which are computation times of solving many small linear systems, with performances of a solver which is implemented using OpenMP and Intel Math Kernel Library (MKL).

GPU Lecture 4

A cooperative method between PGI CUDA Fortran and GPU optimized libraries

Tomohiro Degawa
Lecturer
Department of Electronic Control System Engineering
Numazu National College of Technology

＜Summary＞
Recently, various libraries, optimized for GPU, are released with popularizing GPGPU. Although most of those are assumed that those are used with CUDA C, To make those available with CUDA Fortran allow us to extend suitability of CUDA Fortran for GPGPU.
In this presentation, we introduce Fortran 2003 features including iso_c_binding as a cooperative method between CUDA Fortran and GPU optimized libraries such as cuRAND and cuSPARSE.