

Mutual recognition between PSE and JSME senior analyst

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1. Introduction

Effective use of simulation technology provides benefit of time and cost reduction in product development. To ensure the economic result by such simulation usage, competent simulation engineers are required.

Japan Society of Mechanical Engineers (JSME) launched the Certification Program for Computational Mechanics Engineer in 2003 and there are currently 11 types of certification. NAFEMS had promoted Registered Analyst Scheme since the 1990's and then launched PSE (Professional Simulation Engineer) in 2013.

JSME and NAFEMS confirmed that the highest level senior analyst and PSE are equivalent and now the mutual recognition framework is being discussed. In this presentation, I'm going to introduce the content of JSME Certification Program for CM Engineer, and explain the outline of the framework for international mutual recognition between JSME senior analyst and NAFEMS PSE.

2. JSME Certification Program for Computational Mechanics Engineer

2.1 JSME, CMD (The computational mechanics division of JSME) , Innovation Center

◇ JSME : Established in 1879, 37000 members, 21 divisions.

◇ CMD : Established in 1988. 6000 members.

◇ Innovation Center : Supporting engineers human resource development, engineers certification programs, and technical developments and productive activities. Leading innovation. Enhancement of industry-academia-government collaboration.

JSME Certification Program for Computational Mechanics Engineer is promoted by JSME Certification Program Committee in the innovation center and many members of different JSME divisions including CMD support it.

2.2 JSME Certification Program for Computational Mechanics (CM) Engineer

Field : FEM analysis engineers in solid mechanics field
Analysis engineers in thermal fluid mechanics field
FEM analysis engineers in vibration engineering field

Level : Senior Analyst
Grade 1
Grade 2
Basic Grade

<http://www.jsme.or.jp/cee/cmnteit.htm>

-In cooperation with:

The Japan Machinery Federation(JMF), The Japan Society of Industrial Machinery Manufacturers(JSIM), The Japan Electrical Manufacturers' Association (JEMA), JSME Center for Cooperation of Industries, Government and Academia, Center for Codes and Standards and other 8 divisions and 4 branches, 54 associations related to computational mechanics including JACM (Japan Association for Computational Mechanics) and JSCES (The Japan Society for Computational Engineering and Science) in Japan



2.3 History of JSME's actions

- 2000 Discussion about the certification started as future activities in CMD.
- Mar, 2002 Engineering Training Center "Exploratory Committee for standard and certification of computational mechanics engineers" was established.
- Apr, 2003 Trial run of certification of FEM analysis engineers in solid mechanics field
- Dec,2003 Launch of 2nd grade CM engineers in solid mechanics field
- Dec,2004 Launch of 1st grade CM engineers in solid mechanics field
- Dec,2005 Launch of 2nd grade CM engineers in thermal fluid mechanics field
- Apr,2006 Organization for Promoting ability development "Committee of Certification Program for Computational Mechanics Engineer"
- Apr,2006 Launch of basic grade CM engineers in solid mechanics and thermal fluid mechanics field
- Dec,2007 Launch of 1st grade CM engineers in thermal fluid mechanics field
- 2008 Started the renewal procedure of the certification
- Apr,2009 Innovation center "Committee of Certification Program for Computational Mechanics"
- Sep,2009 Launch of senior analyst in thermal fluid mechanics field
- Jul,2010 Holding the first networking event for certificated CM engineers
- Dec,2012 Launch of 2nd grade of vibration field
- Dec,2013 Launch of 1st grade of vibration field

2.4 2nd Grade Certification Level

◇Solid mechanics field

Engineers who have basic knowledge and skill for linear stress analysis, perform analysis appropriately, and can verify the reliability of the analysis result by oneself.

◇Thermal fluid mechanics field

Engineers who have basic knowledge and skill for “single-phase incompressible flow, compressible flow, laminar flow, and turbulent flow analysis”, perform analysis appropriately and can verify the reliability of the analysis result by oneself.

◇Vibration engineering field

Engineers who have basic knowledge and skill for “natural frequency, frequency response, and transient response analysis”, perform analysis appropriately and can verify the reliability of the analysis result by oneself.

2.5 1st Grade Certification Level

◇Solid mechanics field

Engineers who have basic knowledge and skill for FEM analysis dealing with nonlinearity, and linear fracture mechanics, perform analysis appropriately and can verify the reliability of the analysis result by oneself.

◇Thermal fluid mechanics field

Engineers who have basic knowledge and skill for analysis dealing with one of single-phase flow/multiphase flow/combustion flow, perform analysis appropriately, and can verify the reliability of the analysis result by oneself.

◇Vibration engineering field

Engineers who have basic knowledge and skill for FEM analysis dealing with flow-induced vibration and vibro-acoustic problems, perform analysis appropriately, and can verify the reliability of the analysis result by oneself.

2.6 Senior Analyst Certification Level

◇In solid mechanics, thermal fluid mechanics, and vibration engineering fields, with respect to theories and practical works, engineers who;

①have wider and deeper knowledge and analysis experience (covered by 1st grade and 2nd grade),

②can plan and manage†CAE analysis projects,

③have high ethical standards and

④can present to customers and society.

†In case of management of CAE analysis projects, management for scope (purpose and coverage of projects), schedule, cost, quality, human resource, communication, risk, and procurement is required. Human resource management includes coaching and training of members.

2.7 Characteristics of the examination of thermal fluid mechanics field

- ◇ Thermal-fluid phenomenon is essentially nonlinear and multi-scale. So in practice, introduction of physical model is necessary. (Turbulence flow, multiphase, reaction, combustion, interface, etc.)
- ◇ CFD has been developed depends on each field. (incompressible flow, compressible flow, multiphase flow, combustion flow, etc.)
- ◇ Factually, no standard code: requires different test for each field
- ◇ Problem on the quality assurance: can't assure quality based on standard code
- ◇ Test if engineers have knowhow to use physical model and discretization scheme which are embedded in CFD codes for each field.
(2nd grade: general, 1st grade: field specific)
- ◇ Based on above ideas, for each specific field, certify an ability not to produce results with faults.

2.8 Certification Process

◇2nd Grade : Engineers who have more than 1 year analysis experience or have completed collateral technical course or authorized CAE technical course and accomplished predefined results in the 2nd grade certification tests.

◇1st Grade : Engineers who have 2nd grade certification and accomplished predefined results in the 1st grade certification test.

◇Senior Analyst : Engineers who

- have 1st grade certification
- have more than 7 years analysis experience
- submitted paper related to “typical analysis work experience” and “typical planning and management experience of CAE analysis project ”
- passed a documentary examination (first stage test)
- make a presentation and interview based on the submitted document

2.9 Result of CM engineer certification program 2003-2012

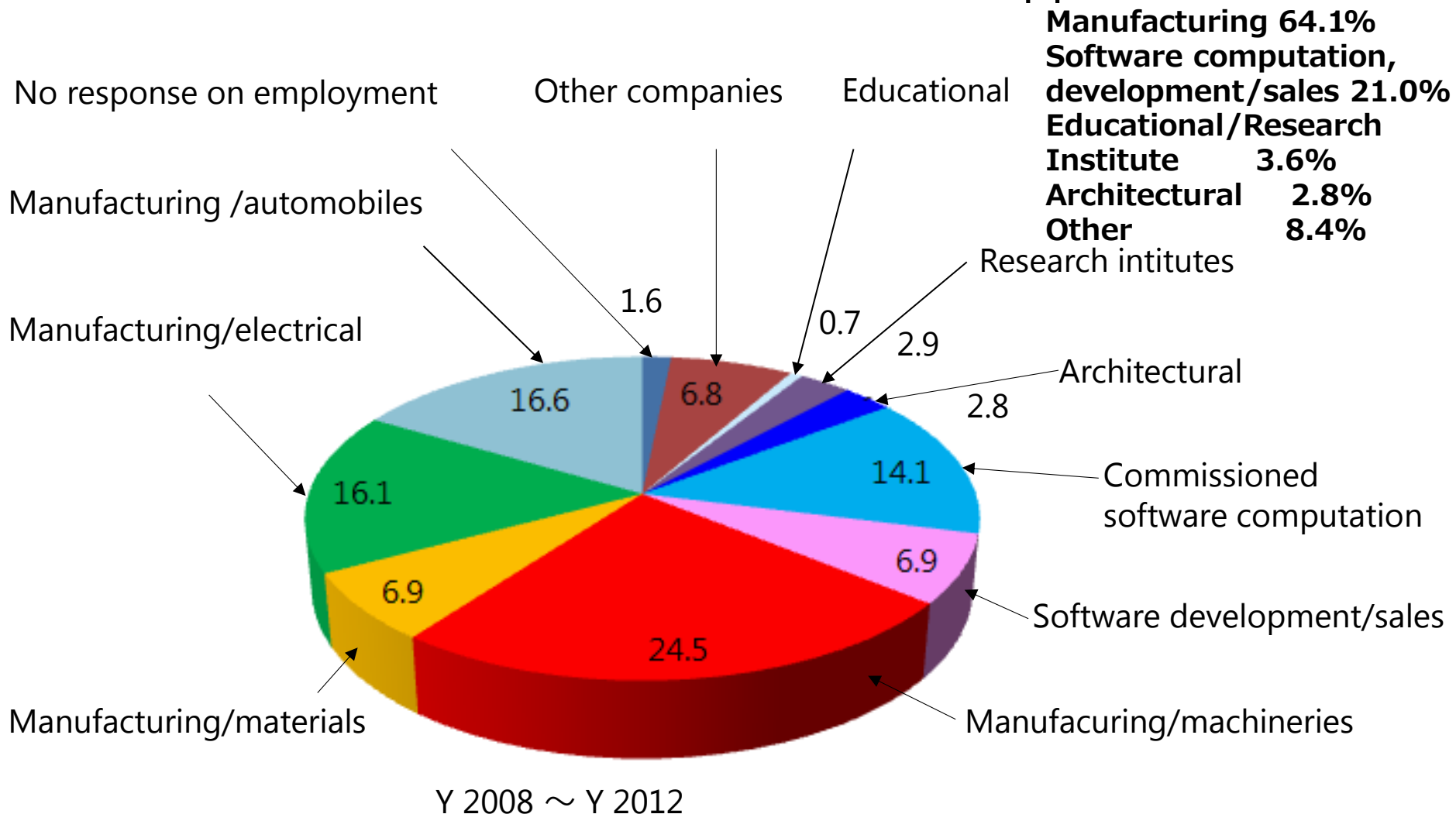
**From Y 2003 to
Y 2012**

**Successful
applicants of CM
engineer in
Solid mechanics,
thermal fluid
mechanics and
vibration
engineering fields
=4542**

**Successful
applicants of senior
analyst in
Solid mechanics and
thermal fluid
mechanics fields=52**

		Solid mechanics				thermal fluid mechanicvibratic				
		basic	2nd	1st	senior	basic	2nd	1st	senior	2nd
2003	Total applica	124	2526	645	—	89	499	108	—	—
-	Successful a	124	987	415	—	89	381	88	—	—
2008	(%)	100	39.1	64.3	—	100	76.4	81.5	—	—
	Total applica	80	534	129	19	23	165	62	8	—
2009	Successful a	80	160	81	12	23	130	34	7	—
	(%)	100	30.0	62.8	63.2	100	78.8	54.8	87.5	—
	Total applica	90	566	134	13	29	162	111	2	—
2010	Successful a	90	164	75	11	29	138	55	2	—
	(%)	100	29.0	0.6	0.8	100	0.9	0.5	100	—
	Total applica	89	596	173	7	34	149	112	3	—
2011	Successful a	89	215	78	6	34	131	49	3	—
	(%)	100	36.1	45.1	85.7	100	87.9	43.8	100	—
	Total applica	101	616	176	5	42	159	120	7	178
2012	Successful a	101	190	95	4	42	141	50	7	132
	(%)	100	30.8	54.0	80.0	100	88.7	41.7	100	74.2
sub total		484	1716	744	33	217	921	276	19	132
total		4542								

2.10 Distribution of industrial affiliation of applicants

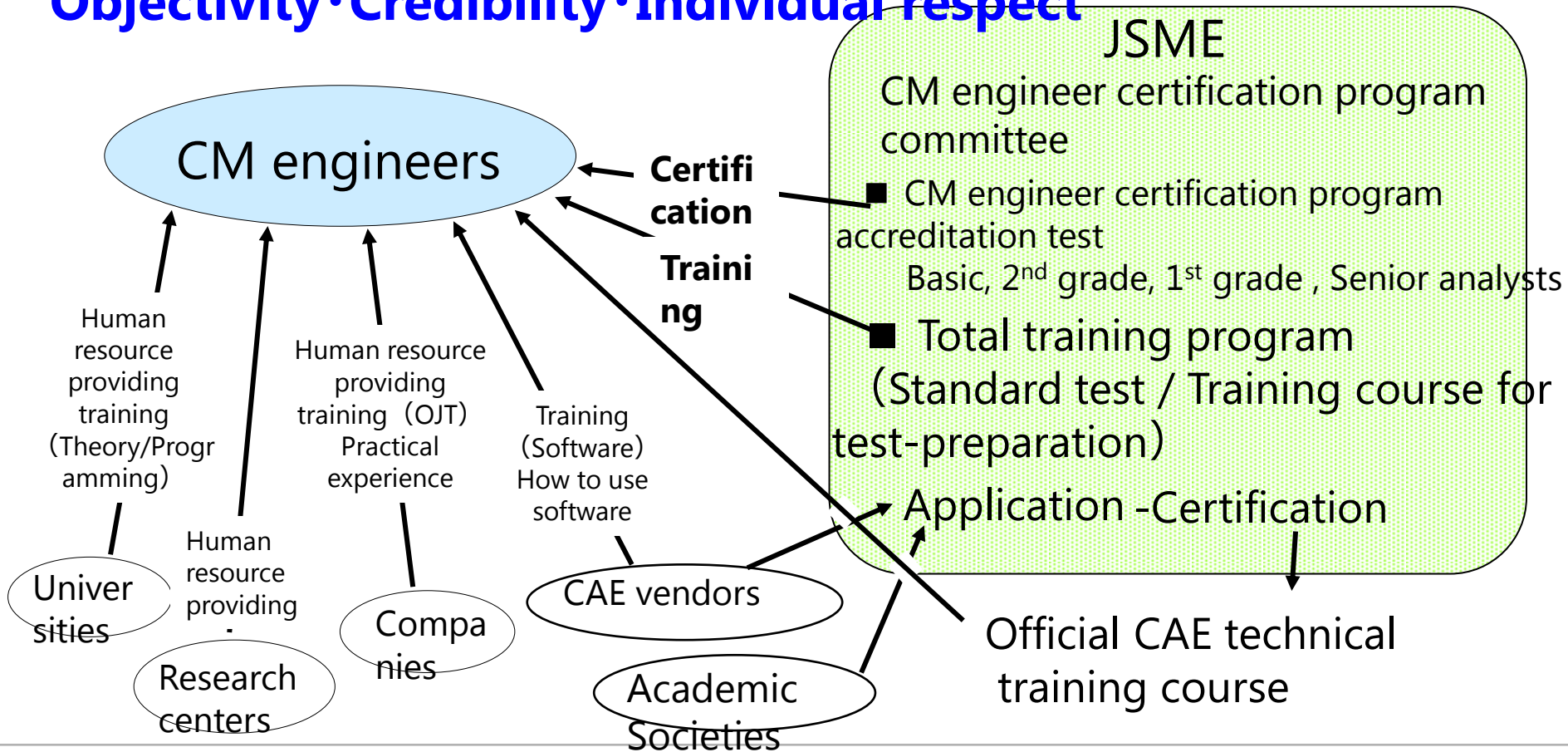


2.11 Concept of CM engineer certification program

**Overseas deployment
Mutual recognition**

Japan standard

Objectivity · Credibility · Individual respect



3. Mutual recognition between PSE and JSME senior analyst

3.1 Discussion between NAFEMS and JSME

- Aug, 2011 JSME visited NAFEMS in Cheshire, UK.
NAFEMS and JSME introduced own computational mechanics engineer certification programs each other.
- Jun, 2012 “International Symposium for quality assurance of computational mechanics” was organized in cooperation of NAFEMS, JSME, JSCES, and JACM.
Equivalence of RA and senior analyst was checked in a following meeting.
- Jun, 2013 NAFEMS launched PSE in NAFEMS WORLD CONGRESS 2013
- Jul, 2013 The practical discussion between NAFEMS and JSME regarding the equivalence between NAFEMS PSE and JSME senior analyst started.
- Aug, 2013 Confirmed the equivalence of NAFEMS PSE and JSME senior analyst. Following discussion about the certification process started.

3.2 Process of Mutual recognition between PSE and JSME senior analyst

◇ Basically, NAFEMS PSE Advanced and JSME senior analyst are thought to be equivalent, because the requirement of senior analyst covers the requirement of PSE Advanced.

◇ However, Regarding one of the PSE requirement “Analysis Type Competency”, senior analysts need to refer the content of “Educational Base Module”, check if himself/herself is Advanced or Standard for each analysis type and apply the analysis type. This is because the understanding of analysis competency is different between NAFEMS and JSME. JSME checks the project essay, work experience and the propriety of the applied analysis types which are provided by senior analysts to JSME.

◇ NAFEMS and JSME will continue the consideration of detail of mutual recognition.

3.3 Possible Analysis Type Competency that senior analysts can apply

◇ Choosing following Analysis Type Competency

Core Finite Element Analysis	固体	Core module	(Solid Mechanics)	
Core Computational Fluid Dynamics	熱流体			
Mechanics, Elasticity and Strength of Materials	固体	Basic module	(Thermal Fluid Mechanics)	
Beams, Membranes, Plates and Shells	固体			
Fundamentals of Flow, Heat and Mass Transfer	熱流体			
Materials for Analysis and Simulation	固体			
Composite Material and Structures	固体	Specific module	(Solid Mechanics)	
Fatigue	固体			
Flaw Assessment and Fracture Mechanics	固体			
Thermo-Mechanical Behaviour	固体			
Buckling and Instability	固体			
Dynamics and Vibration	振動			(Vibration)
Noise and Acoustics	振動			
Multi-body Dynamics	振動			
Nonlinear Geometric Effects and Contact	固体			※Regarding vibration, it is held until senior analyst certification starts
Plasticity	固体			
Creep and Time-Dependency	固体			

4. Advantage of the mutual recognition

◇Senior Analysts

By obtaining PSE developed in Europe, JSME senior analysts can gain certification as world class professional competency and confidence. In addition, they can participate in the global computational mechanics engineers community.

◇JSME

By taking the opportunity of international mutual recognition, JSME senior analysts will be accepted internationally and an increase of the number of senior analyst applicants can be expected.

◇NAFEMS

By this mutual recognition, it produces PSE registrants in Japan. As a result, it raises the profile of NAFEMS. The new PSE registrants in Japan can create NAFEMS community together with the existing NAFEMS members.

5. Conclusion

This presentation introduced the content of JSME Certification Program for CM Engineers, and explained the outline of the framework for international mutual recognition between JSME senior analyst and NAFEMS PSE.

This international mutual recognition is an opportunity for JSME senior analysts to gain certification as world class professional competency and confidence, and to participate in the NAFEMS community.

JSME can expect a higher reputation of senior analysts and increase of the number of senior analyst applicants. NAFEMS can expect an opportunity for increase of PSE registrants and a new NAEFMS community in Japan.

I strongly expect that this interaction of simulation technology between Europe and Japan by taking the opportunity of international mutual recognition, activates the Japanese simulation industry and produces an additional effect of leading simulation technology in the manufacturing industry in Japan.

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