AFDEX Newsletter
2017 Summer

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1. AFDEX_V17R00

AFDEX_V17R00(AFDEX Advanced) was released on July 1st, 2017 and the version for international users will be released on early October. Main features of this release are not only an enhancement of some functions of previous version by reflecting users' demands but also addition of new functions such as assembled die analysis considering shrink fit and elastic die deformation.

1.1 Shrink fit analysis of assembled die

Figure 1.1 and 1.2 show 2D/ 3D simulation results of assembled dies considering shrink fit. The shrink fit analysis of an assembled die basically includes interference fit. Die elastic deformation caused by shrink fit can be adopted or ignored when the die is modified on post processing. Of course, die stress regarding shrink fit is always reflected. In the figure below, effective stress contours by shrink fit on 1st step are presented. The condition applying preload to part fitted with shrink ring is only applied in the example of 2D process.

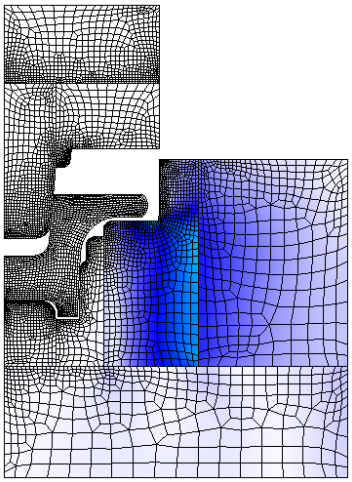


Fig. 1.1 2D

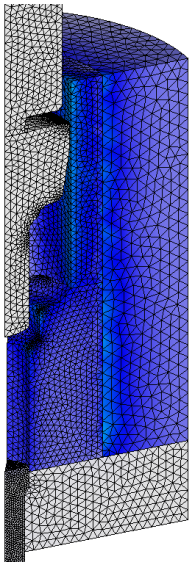


Fig. 1.2 3D

The earlier 2D/3D function for die shrink fit was readily applicable when the contact surface between the inner surface of compression ring and the outer surface of die were completely in contact with each other in a straight line. This function has been now modified and it additionally allows the user to carry out an assembled die shrink fit analysis even when the contact happens over stepped surfaces.

1.2 Assembled die analysis considering die elastic deformation

In AFDEX_V17R00 (AFDEX Advanced), the elastic die structural analysis of an assembled die is possible. In earlier version, the dies were assumed to be rigid in the case of an assembled die analysis. If the professional version is being used currently and the user is currently in a maintenance contract and would want to upgrade to the advanced version, 50% of the price difference between the two versions can be paid and the version can be upgraded.

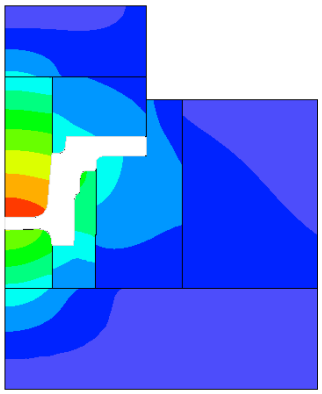


Fig. 1.3 2D

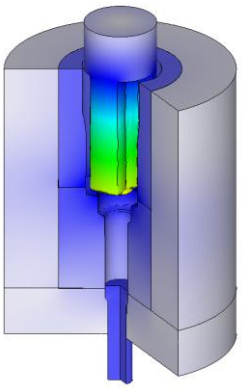


Fig. 1.4 3D

1.3 Heat treatment analysis

The beta version of AFDEX – HT will be released on September 1st, 2017. Figure 1.5 shows 2D/ 3D result of Jominy test using heat treatment module. Both 2D and 3D results are similar because they can get the stable temperature change although this test is quenching process as shown in figure 1.6. Additionally, figure 1.7 shows that plotting hardness can be expected in the beta version of AFDEX – HT.

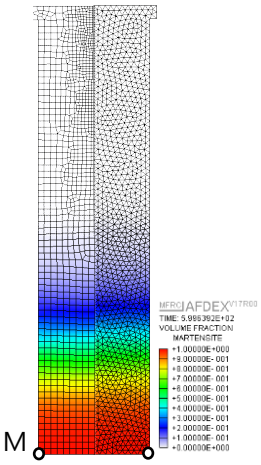


Fig. 1.5 2D(Left) and 3D(Right) Jominy test results (Fractions of martensite)

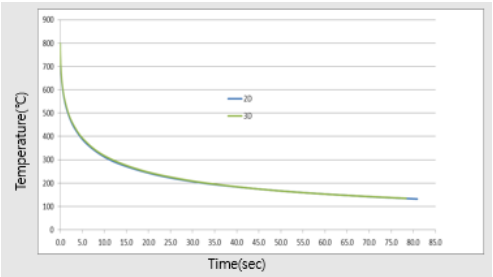


Fig. 1.6 2D/ 3D temperature comparison at point M

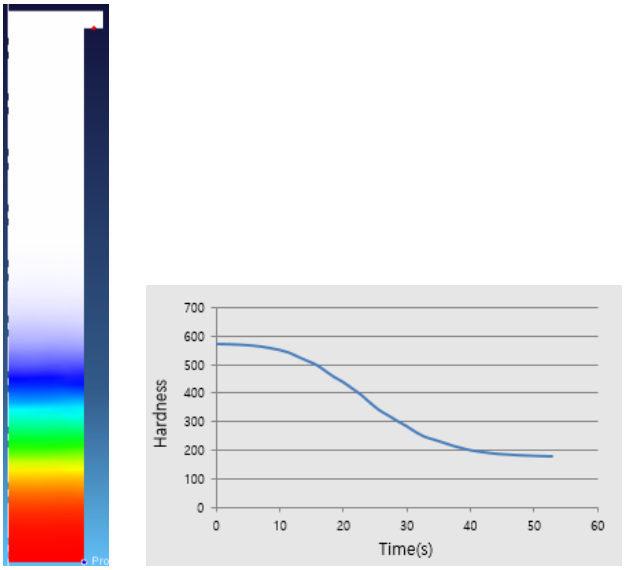
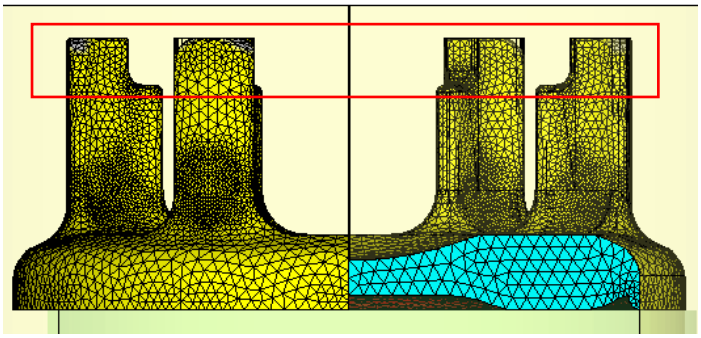


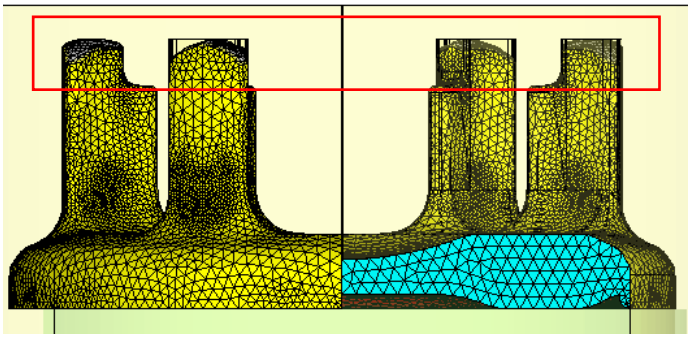
Fig. 1.7 2D Jominy test result (Hardness)

1.4 3D air pocket analysis

The 2D analysis function considering air pocket has been provided since 2012. From this latest release, AFDEX_V17R00, 3D function of air pocket analysis will also be offered. Figure 1.8 shows the comparison of simulation results with and without consideration of air pocket.



(a) Without air pocket

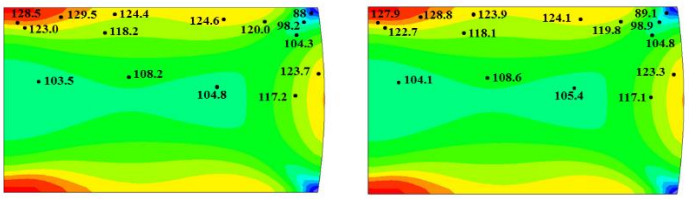


(b) With air pocket

Fig. 1.8 Comparison of air pocket analysis

1.5 Optimized process design and variable

Figure 1.9 (a) shows predictions of grain size with known material properties and figure 1.9 (b) shows predictions of grain size with material properties calculated by a new material identification scheme, which is based on AFDEX and HyperStudy. The new scheme needs experimental data as input to identify the material. In this study, the experimental input was replaced by the predictions obtained using the known material properties. As can be seen in these two figures, they are very close to each other, implying that the scheme of material identification for predicting microstructural evolution is powerful and economical.



(a) With known material data (b) With identified material data

Fig. 1.9 Comparison of material data type

2. Public notice

2.1 Purdue University, USA – Seminar, Cooperative project

A seminar evaluating first year research results on multi-scale microstructure prediction was held at Purdue university, USA. The research team of Purdue university has been carrying out this project since 2016 and it was supported by MFRC. Professor Yung C. Shin of Purdue university attended this meeting. Based on the project results, it was discussed that these new features will be added to next AFDEX release.

Meanwhile, Professor Shin conducted special lectures on laser machining, macroscopic, microstructural changes and strength of materials for graduate and undergraduate students at Gyeongsang National University. Professor Shin Yung-chul is a world-renowned technologist who boasts an average of more than 1000 research papers per year, and his main field of activity is the evaluation of laser application and mechanical, metallurgical properties.

Fig. 2.1 Purdue University Seminar

2.2 MFCAE 2017

MFCAE2017 will be held in Changwon Pullman hotel, Korea on August 17th to 18th, 2017. This event will consist of not only oral and poster presentations but also discussion between developers and users. In developer's presentation session, major topics are introduction of AFDEX's new functions, its application and explanation in detail. The discussion between developers and users will be a great opportunity to know the users' demands and enhance the advanced metal forming technology.

There are about 70 posters that are planned to be presented at the poster session. Poster topics will be displayed on a one-to-one basis within a wide range of new and existing simulation technology. In addition, this poster session will be used as a forum for mutual knowledge transfer where participants can have enough time for 5 hours on the first day and 3 hours on the second day.

Through this session, participants can broaden the understanding of key features and give their own demands to developers clearly. If the user expresses special interest in metal forming technology through the registration format, you may get a chance for in-depth technical exchange.

We would appreciate your active interest and participation in the session. The accommodation expenses for one day will be provided for presenters of the oral or poster sessions. The topics that have been registered currently can be found below.

Table 2.1 MFCAE 2017

Venue	Date	City
Pullman hotel	2017.08.17~18	Changwon

Table 2.2 MFCAE 2017 Schedule

Date	Title
Aug. 17th	Poster session
	AFDEX developer's oral session
	User's oral session
	Developer-User discussion
	Introduction of new function in AFDEX_V17R00
Aug. 18th	Poster session

2.3 International event

EATC 2017

2017 European
Altair Technology Conference

ATC Europe 2017

June 26-28, 2017
Frankenthal, Germany

The EATC was held at the Frankenthal Congress Forum in Germany for three days from June 26 to 28. Participants were the PLM technology industry group including automobile parts manufacturers. The exhibition consisted of an APA partners' booth exhibition and an academic presentation, all of which were beneficial for the participants.

Fig. 2.2 MFRC on EATC 2017

MFRC also gave a positive impression to new partners and other visitors through oral presentations and booth exhibitions at this exhibition and create visibility in the European market.

MF-Tokyo 2017

MF-Tokyo 2017

July 12-15, 2017
Tokyo, Japan

MF-Tokyo 2017, a specialized exhibition of machinery industry technology, will be held at Tokyo Big Sight Exhibition Center for four days from July 12 to 15. This event brings together metal forming machines, automated equipment, related equipment, processing technologies and service technologies for manufacturing industries. About 30,000 visitors and 1,300 exhibition booths are expected to be present this year. MFRC will set up an exchange platform for the machinery industry at Hall 5, booth number 57. JSOL also participates in this event and exhibits AFDEX jointly. JSOL, a Japanese partner of MFRC, is the largest software company in Japan and a subsidiary of Mitsui Sumitomo Bank and NTT Docomo.

2.4 Shanghai Fastener Expo 2017

BRIMET, a Chinese agency of MFRC, participated in Fastener Expo at the end of June. BRIMET is a representative research institute of metal forming and heat treatment in China and plays a leading role in related academic and industrial organizations in China. MFRC and BRIMET are strengthening cooperation in the fields of microstructure and heat treatment prediction, and non-ferrous metals.

Fig. 2.3 Shanghai Fastener Expo 2017

2.5 GISPAM 2017

GISPAM 2017 will be held at Gyeongsang University and the Korea Mold Center. This fruitful program will be proceeded for five weeks starting on July 16. There will be 20 distinguished scholars from Mexico, 2 university students from Malaysia, 2 businessmen from Mexico and 10 graduate students and undergraduates from Gyeongsang National University. All cost of Mexican participants will be covered by the Mexican state government and company.

GISPAM has evolved into its fourth year, starting from a AFDEX training request from the Mexican government four years ago. Currently, this program includes not only AFDEX training but also the company's software education which is active in overseas market development of engineering software developed in Korea.

Participants in GISPAM education are selected from the top 5% of the universities in Mexico based on academic standards. This training will be conducted in English. Week 1: CAD and Mathematical Background, Week 2: Mechanics and AFDEX, Week 3: AFDEX and AnyCast assignments, Week 4: Injection Molding and CAM, Week 5: Korean Culture Experience and Company Visit / Presentation evaluation.

Gyeongsang University students and up to 10 AFDEX users are also allowed to participate in GISPAM education. If you would like to take part in this program, it's recommended to make a reservation in advance. The 6th AFDEX training will be replaced by GISPAM 2017 2nd round training. Users who need CAD training are encouraged to participate in the first week training.

Figure 2.3 shows the participants of GISPAM 2016 visiting Sungjin Foma, an excellent user of AFDEX.

Fig. 2.4 GISPAM 2016, Sungjin Foma

A. MFCAE 2017

A.1 Oral Sessions

	Title	Authors
1	State-of-the-art and near future of AFDEX	Prof. M. S. Joun (GNU)
2	Elastoplastic finite element analysis of plate and sheet metal forming processes	Prof. W. J. Chung (SNUST)
3	Tri-axiality of stresses in predicting material fracture	Prof. S. M. Hong (KNU)
4	Heat treatment simulation using AFDEX	Prof. K. O. Lee (BNU)
5	Updated functions of PRE/POST-processor	Dr. Lee (MFRC)
6	To be determined	Dr. Zhai (BRIMET)
7	Material identification for prediction of microstructural evolution	Mr. Irani (GNU)
8	Induction heating in AFDEX	Prof. D. H. Yoo (POSTECH)
9	Process optimization using AFDEX and HyperStudy	Dr. S. H. Chung (MFRC)
10	Incremental forming simulation	Dr. H. K. Moon (MFRC)
11	Multi-scale microstructure evolution prediction	Prof. Y. Shin (Purdue Univ.)
12	Application of AFDEX for developing hot forging processes for automation	Mr. C. H. Lee (Dongeun Forging)
13	Elastoplastic FEA to develop precision automatic multi-stage cold forging processes	Mr. T. M. Hwang (Sungjin FOMA)
14	Die life prediction	Mr. R. Sekar (MFRC)
15	Applications of AFDEX in Japan	Mr. M. Yanagisawa (JSOL)

A.2 Poster Sessions

	Title	Authors
	Posters related to the oral presentation	
A1	State-of-the-art and near future of AFDEX	Prof. M. S. Joun (GNU)
A2	Elastoplastic finite element analysis of plate and sheet metal forming processes	Prof. W. J. Chung (SNUST)
A3	Tri-axiality of stresses in predicting material fracture	Prof. S. M. Hong (KNU)
A4	Heat treatment simulation using AFDEX	Prof. K. O. Lee (BNU)
A5	Updated functions of PRE/POST-processor	Dr. Lee (MFRC)
A6	To be determined	Dr. Zhai (BRIMET)
A7	Material identification for prediction of microstructural evolution	Mr. Irani (GNU)
A8	Induction heating in AFDEX	Prof. D. H. Yoo (POSTECH)
A9	Process optimization using AFDEX and HyperStudy	Dr. S. H. Chung (MFRC)
A10	Incremental forming simulation	Dr. H. K. Moon (MFRC)
A11	Multi-scale microstructure evolution prediction	Prof. Y. Shin (Purdue Univ.)
A12	Application of AFDEX for developing hot forging processes for automation	Mr. C. H. Lee (Dongeun Forging)
A13	Elastoplastic FEA to develop precision automatic multi-stage cold forging processes	Mr. T. M. Hwang (Sungjin FOMA)
A14	Die life prediction	Mr. R. Sekar (MFRC)
A15	Applications of AFDEX in Japan	Mr. M. Yanagisawa (JSOL)
	Fundamentals of AFDEX	
B1	Success story and contribution-to-forging of AFDEX	MFRC
B2	Success story	MFRC
B3	Accuracy of AFDEX	MFRC
B4	Factors affecting on accuracy of metal forming simulation	MFRC
B5	State-of-the-art of AFDEX	MFRC
B6	Near-future of AFDEX	MFRC
B7	Cooperation with the related organizations	MFRC
	AFDEX New functions or special functions/usages	
C1	List of new or special functions and modules	MFRC
C2	L-bending process with unloading condition	MFRC
C3	U-bending process with workpiece hardening	MFRC
C4	Cold forging process with die elastic deformation	MFRC
C5	Cold forging process with shrinkage fitting	MFRC
C6	Fine blanking process	MFRC
C7	Self-piercing riveting	MFRC
C8	A long-bar drawing	MFRC
C9	Stage-by-stage simulation	MFRC
C10	Non-isothermal analysis with thermal load	MFRC
C11	Superplastic forming	MFRC
C12	Shape rolling	MFRC
C13	Open-die forging	MFRC
C14	Cross wedge rolling	MFRC
C15	Roll forging	MFRC
C16	Flow forming or rotary forming simulation	MFRC
C17	3D air-trapping simulation	MFRC
C18	Grouped die treatment	MFRC
C19	Material identification from tensile test	MFRC
C20	Material identification from compression test	MFRC
C21	2D complete analysis	MFRC
C22	3D complete analysis	MFRC
C23	2D and 3D Jominy test	MFRC
C24	Rotary forming	MFRC
C25	Flow forming	MFRC
C26	Simulation of assembled die hot forging processes considering heat transfer	MFRC
C27	Ring rolling	MFRC
C28	Radial forging	MFRC
C29	2D multi-point die	MFRC
C30	Cold forging simulation considering air trapping	MFRC
C31	Recursive simulation of hot forging process to predict real die temperature	MFRC
C32	Simulation of assembled die cold forging processes considering shrink fit	MFRC
C33	Simulation of assembled die cold forging processes considering elastic deformation	MFRC
	Typical applications	
D1	Elastoplastic finite element modeling of an ultrasonic surface rolling process	Missam Irani(GNU)
D2	Forging simulation considering die elastic deformation	Dr. Chung(MFRC)
D3	Fixed scroll forging simulation and its verification	Mr. Kim(GNU)
D4	Process optimization using AFDEX and HyperStudy	Mr. Kim (Altair Korea)
D5	Simulation of forging process with elastic deformation of press considered	Akash Meena(GNU)
D6	State-of-the-art Korean forging technology with emphasis on forging	Mr. Choi(Samwoo)

	simulation	
D7	Practical application examples of AFDEX in automatic multi-stage cold forging	Mr. Kim (Sungjin Fo-Ma)
D8	Die elastic deformation analysis using AFDEX	Mr. Kim(SNUST)
D9	Causes of premature die fracture and process design improvements	Mr. Bae (Hyundai Fastener)
D10	Study on CAM punch die fracture due to accumulative strain in multi-stage deep drawing	Prof. Hong (Kongju Nat'l Univ.)
D11	Elastoplastic finite element analysis of a bulgy cup progressive forming process	Mr. Cho(SNUST)
D12	Die and process design to increase locally thickness in square-cup sheet metal forming	Prof. Hong (Kongju Nat'l Univ.)
D13	Minimization of springback using bottoming in sheet metal forming	Prof. Hong (Kongju Nat'l Univ.)
D14	Study on initial blank geometry to increase formability in multi-stage deep drawing of an elliptical material deep drawing	Prof. Hong (Kongju Nat'l Univ.)
D15	Design optimization of piercing punch geometry for TEE-shape pipe manufacturing	KNU
D16	Precision forging simulation of LPI housing part using 3D air trap of closed dies	KNU
D17	Simulation of punch fracture for pipe piercing process considering elastic deformation of punch	KNU
D18	Forming limit analysis of T-Al clad sheet metal considering stress axiality	KNU
D19	Study on effect of piecing condition to hole expansion ratio(HER) test	KNU
D20	New 1	BRIMET
D21	New 2	BRIMET
D22	New 3	BRIMET
D23	Roll forging simulation and its verification	(GNU)
D24	Chevron crack in multi-stage open extrusion	GNU
D25	Precision simulation of a cold extrusion process	GNU
D26	Practical material identification for microstructural evolution prediction	GNU
D27	Springback due to material removal	MFRC
D28	Optimized mesh system for ring rolling	MFRC
D29	Complete analysis of aluminum fixed scroll hot forging process	GNU
D30	Effect of geometric variables on roundness	Sungjin FOMA/GNU
D31	Die elastic deformation and material elastoplastic deformation	MFRC/GNU
D32	Punch fracture in a piercing process of a hot-stamped material	KNU
D33	Springback analysis with temperature effect considered	MFRC
D34	Numerical and experimental study on die deformation in hot forging	MFRC/GNU
D35	Forging simulation with press deformation considered	GNU
D36	Complete simulation of a hot forging process considering die deformation due to mechanical and thermal loads	MFRC/GNU
D37	Material-die deformation coupled simulation with shrink fit considered	MFRC
D38	Precision simulation based on mesh density optimization	MFRC
D39	Prediction of die temperature change in long rod drawing	MFRC
D40	Analysis of material deformation in double shear-twisting extrusion	GNU
D41	Die geometry optimization in forging using AFDEX and HyperStudy	MFRC
D42	Progressive plate forging of vibration motor base plate	SNUST
D43	3D Die elastic deformation analysis using AFDEX	SNUST
D44	3D analysis of a bulge cup progressive forming	SNUST
Education		
E1	TBD	GISPAM Team 1
E2	TBD	GISPAM Team 2
E3	TBD	GISPAM Team 3
E4	TBD	GISPAM Team 4
E5	TBD	GISPAM Team 5
E6	TBD	GISPAM Team 6