M2D2015

P. Delgada/Portugal

6th International Conference on

MECHANICS AND MATERIALS IN DESIGN

P. Delgada/Azores, 26-30 July 2015

M2D2015

PROGRAM

University of Porto
University of Toronto
University of Azores

14:00-19:00	POSTERS SESSION - 3 TOPICS: B, G, H, K ; SYMPOSIA: 6, 19, 21	Lobby

Topic: B
Ref: 5372
STUDY OF WELDING LINE UNRIPPING TEST OF METAL BELLOWS. Zhongbin Tang, Yulong Liu, Tao Suo, Qiong Deng
Ref: 5466
ANALYSIS OF THE AIRCRAFT OPERATION IN THE CONTEXT OF SAFETY AND EFFECTIVENESS. Jozef Zurek, Antoni Jankowski, Jan Rajchel
Ref: 5544
REMARKS TO TESTING OF STRENGTH AND FATIGUE LIFE. Miloslav Kepka, Jan Chvojan
Ref: 5581
INFLUENCY OF HEAT TREATMENT IN THE MECHANICAL PROPERTIES AT HIGH TEMPERATURES OF P91 STEEL-PIPE WELDED JOINTS. Tatiane Chuvas, António Correia da Cruz, Manuel Gomes, Maria Cindra Fonseca
Ref: 5645
VANE SEGMENT CASTING GEOMETRY IMPACT ON THE STRESS IN THE AIRFOIL SURFACE LAYER. Pawel Kocurek, Pawel Rokicki, Rafal Cygan, Jacek Nawrocki, Andrze Nowotnik, Jan Sieniawski
Ref: 5653
HEAT TREATMENT EFFECT ON MICROSTRUCTURE AND PROPERTIES OF SINGLE CRYSTAL CMSX-4® NICKEL-BASED SUPERALLOY. Andrzej Nowotnik, Pawel Rokicki, Grzegorz Jakubowicz, Daniel Kurkowski, Grazyna Mrowka-Nowotnik, Malgorzata Wierzbinska, Jan Sieniawski, Jacek Nawrocki
Ref: 5674
FATIGUE BEHAVIOR AND CUMULATIVE DAMAGE OF NOTCHED GFR COMPOSITES. Alessio Carofalo, Vito Dattoma, Riccardo Nobile, Fania Palano, Francesco Panella
Ref: 5693
INVESTIGATION OF THE MECHANICAL BEHAVIOUR OF ZIRCONIUM ALLOY AT DIFFERENT STRAIN RATES USING SUB-SIZE TENSILE SPECIMENS. Pavel Konopik, Martin Rund, Jan Dzugan
Ref: 5775
TOOL CONDITION MONITORING IN DRILLING BASED ON SPINDLE AND FEED MOTOR CURRENT. Alfonso González, David Rodríguez, Justo García Sanz-Calcedo, Inocente Cambero, José Herrera

Topic: G
Ref: 5352
SMALL-SCALE STRAIGHT-BLADED DARRIEUS VERTICAL AXIS WIND TURBINE. Rafael de Almeida Alves, Carlos Alberto Gallo
Ref: 5454
LIFE CYCLE ANALYSIS (LCA) AND RELIABILITY TECHNIQUES IN INDUSTRIAL DESIGN PROJECTS. Justo Calcedo, David Salgado, Alfonso Gonzalez, Inocente Rivero, José Herrera
Ref: 5603
CONSIDERATIONS ON OPERATION OF A TURBOJET ENGINE WITH THE 'BYPASS' DESIGN. Miroslaw Kowalski
Ref: 5760
SPATIAL FACE RACK DRIVES: MATHEMATICAL MODELS FOR SYNTHESIS AND SOFTWARE ILLUSTRATIONS. Emilia Abadjieva

Topic: H
Ref: 5410
THREE-DIMENSIONAL EFFECTS ON WELDED LAP JOINTS UNDER TENSILE-SHEAR LOADING. Filippo Berto, Alberto Campagnolo
Ref: 5667
EVALUATION OF STAINLESS STEEL PLATES OF HEAT EXCHANGER DAMAGE. H. Abdel-Aleem, B. Zaghloul, S.A. Khodir

Topic: K
Ref: 5584
MEASUREMENT OF INPUT ACOUSTIC IMPEDANCE OF HUMAN AUDITORY SYSTEM. Daniel Carmona, Leonardo Molisani, Maria Bellini
Ref: 5696
ANALYSIS OF THE CORE STABILITY TO IMPROVE SINGLE LEG STANCE (CASE STUDY). Ana Couto, Mário Vaz, Sara Morais

Symp: 6
Ref: 5618
NUMERICAL SIMULATION OF WALL DEFORMATION IN AN ANEURYSM MODEL. João Ribeiro, Rui Lima, Hernani Lopes, Mário Vaz, J.F. Silva Gomes

Symp:19
Ref: 5407
MAGNETIC CHARACTERIZATION BY EDDY CURRENT TESTING TO EVALUATE THE AGED MICROSTRUCTURE OF REFORMER FURNACE TUBES. João Rebello, M. Arenas, M.C.L. Areiza, L.H. Almeida, R. Sacramento, G.R. Pereira
Ref: 5420
MEASUREMENT OF RESIDUAL STRESSES IN WELDED ELEMENTS AND STRUCTURES BY ULTRASONIC METHOD. Yuri Kudryavtsev, Jacob Kleiman, Lana Potapova
Ref: 5447
MINIATURIZED SAMPLES CREEP TEST AS A NON DESTRUCTIVE SOLUTION. Heloisa Furtado, Fernanda Santos, Luiz Almeida, Luisa Coutino
Ref: 5532
INFLUENCE OF SUPERALLOY CASTING STRUCTURE ON PROPAGATION OF ULTRASONIC WAVE. Jacek Nawrocki, Kamil Gancarczyk, Wojciech Manaj, Robert Albrecht, Rafal Cygan, Krzysztof Krupa, Jan Sieniawski
Ref: 5661
EVALUATION OF FATIGUE PROPERTIES OF NICKEL BASED SUPERALLOY MAR 247 WITH ALUMINIDE COATING AND CRACK DETECTION BY NON-DESTRUCTIVE TECHNIQUES. Dominik Kukla

Symp: 21
Ref: 5675
MACHINED SURFACE ANALYSIS AT HIGH CUTTING SPEED USING CARBIDE DRILL IN A AL-SI ALLOY. Paulo S. Martins, José R.G. Carneiro, Gilmar C. Silva, Pedro P. Brito

19:30-24:00	CONFERENCE BANQUET	Coliseu Micaelense

NUMERICAL SIMULATION OF WALL DEFORMATION IN AN ANEURYSM MODEL

Ribeiro[1], J., Lima[2], R., Lopes[3], H., Vaz[4], M., Gomes[4], J.

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1- INTRODUCTION

Aneurysms are the fourth most common cause of cerebrovascular disease in adults, after the ischemic attacks, thrombotic and hypertensive cerebral hemorrhage. In Europe, the cerebrovascular diseases is the leading cause of mortality (Branco, 1992). The causes for the occurrence of aneurysms is the deterioration of the arterial wall is the hypertension. Other causes include hereditary connective tissue disease, congenital cardiovascular abnormalities or atherosclerosis. The most common approach for the study of aneurysms behavior is made from analysis of the blood flow in this region and deformation produced by blood pressure. One of the key features in this study is the definition of the arteries tissues mechanical properties. Some studies have shown that arterial tissues have a typical hyper-elastic behavior (Masson, 2008).

2- NUMERICAL SIMULATIONS

The numerical simulation are made using Finite Volume Method (FVM) and finite element method (FEM) , commercial package simulation software ANSYS ®.

The numerical simulations were accomplished in two steps. In the first, is analyzed the fluid flow inner the channel. The second, is based on the structural deformation analysis due to the internal pressure of fluid. In Fig. 1 and 2 are represented the geometries used for both simulations

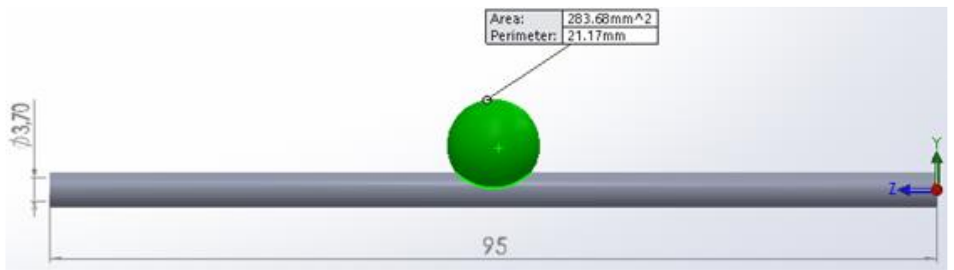

Figure 1 - Dimensions of the inside part, for the study of fluid flow.

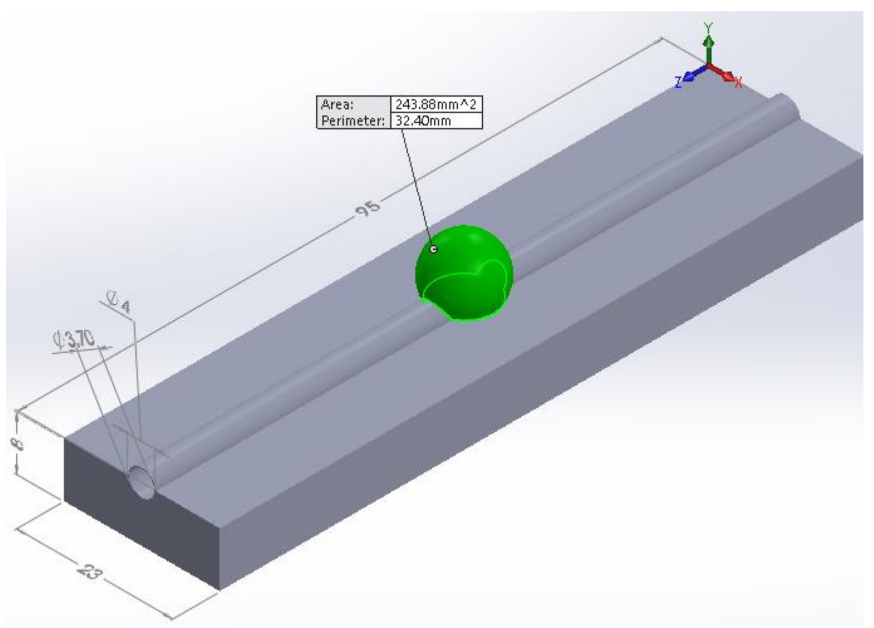

Figure 2 – Outer part dimensions, for the study of the mechanical behavior of the channel.

For fluid flow simulation was used the *Fluent* module of the Ansys® and for wall deformation was simulated using the *Structural* module.

Simulations of fluid flows were performed for glycerol 60%, which features well known properties and sufficient viscosity to measure the pressure drops. At temperature of 20° C, the properties of this fluid are: density (ρ) of 1153.8 kg/m3 and viscosity (η) equal to 1.08e-2 Pa.s. The imposed simulation conditions were: boundary conditions, no slip at the wall, a constant velocity inlet and the volumetric flow rate was 300 μl/min. The mesh presented in Fig. 3 is based on CutCell method, with an element size equal to 0.25mm, having a total of 352045 nodes and 344508 elements.

In the structural simulation was considered the PDMS material. This material has a hyperleastic behavior, which was implemented using the numerical model of Mooney-Rivlin. The mesh used for the discretization of outer part, Fig.4, has an element size of 0.90mm, being a total mesh form by 42898 nodes and 24045 elements.

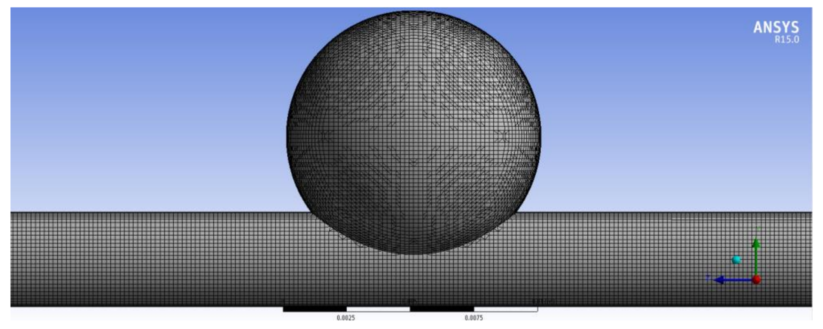

Figure 3 - Mesh used for the inside of the channel.

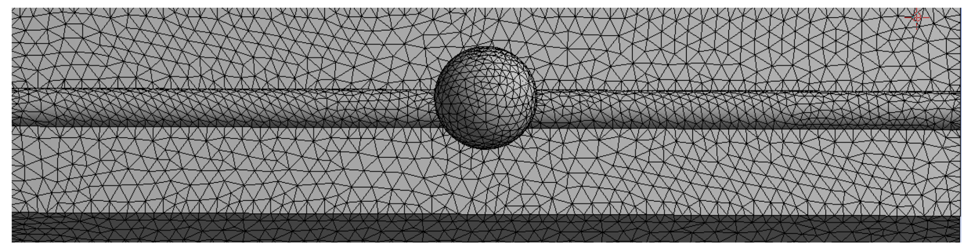

Figure 4 - Mesh used for the outer part of the channel (wall).

3- RESULTS

In Fig. 5 is represented the fluid velocity field in the aneurysm model.

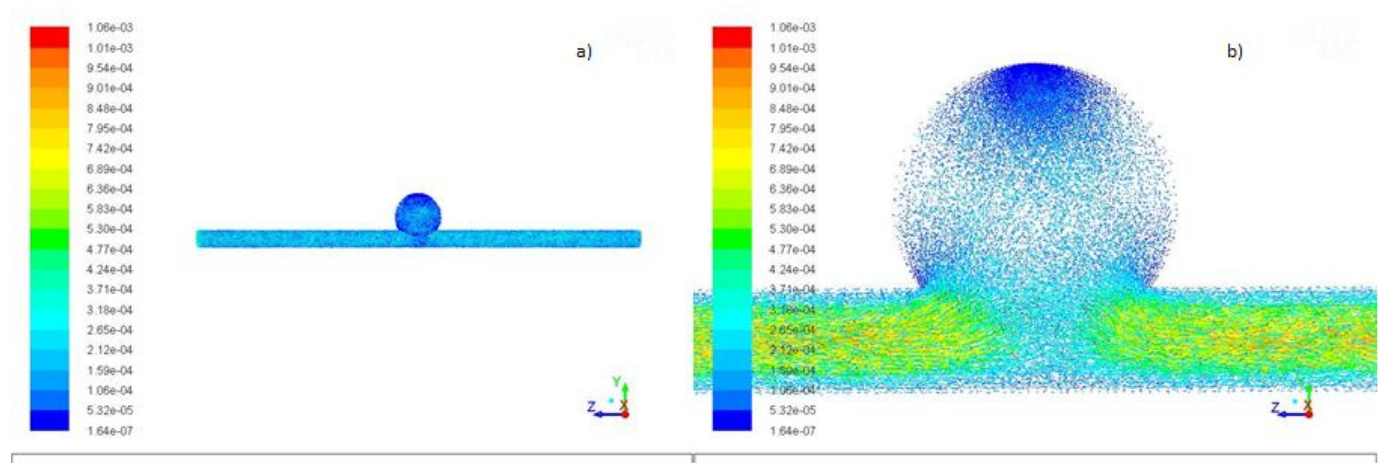

Figure 5 - Fluid velocity vectors. All model (a) and in aneurysm region (b)

In the Fig. 6 is shown the displacement field caused by internal pressure when fluid passes inside the channel.

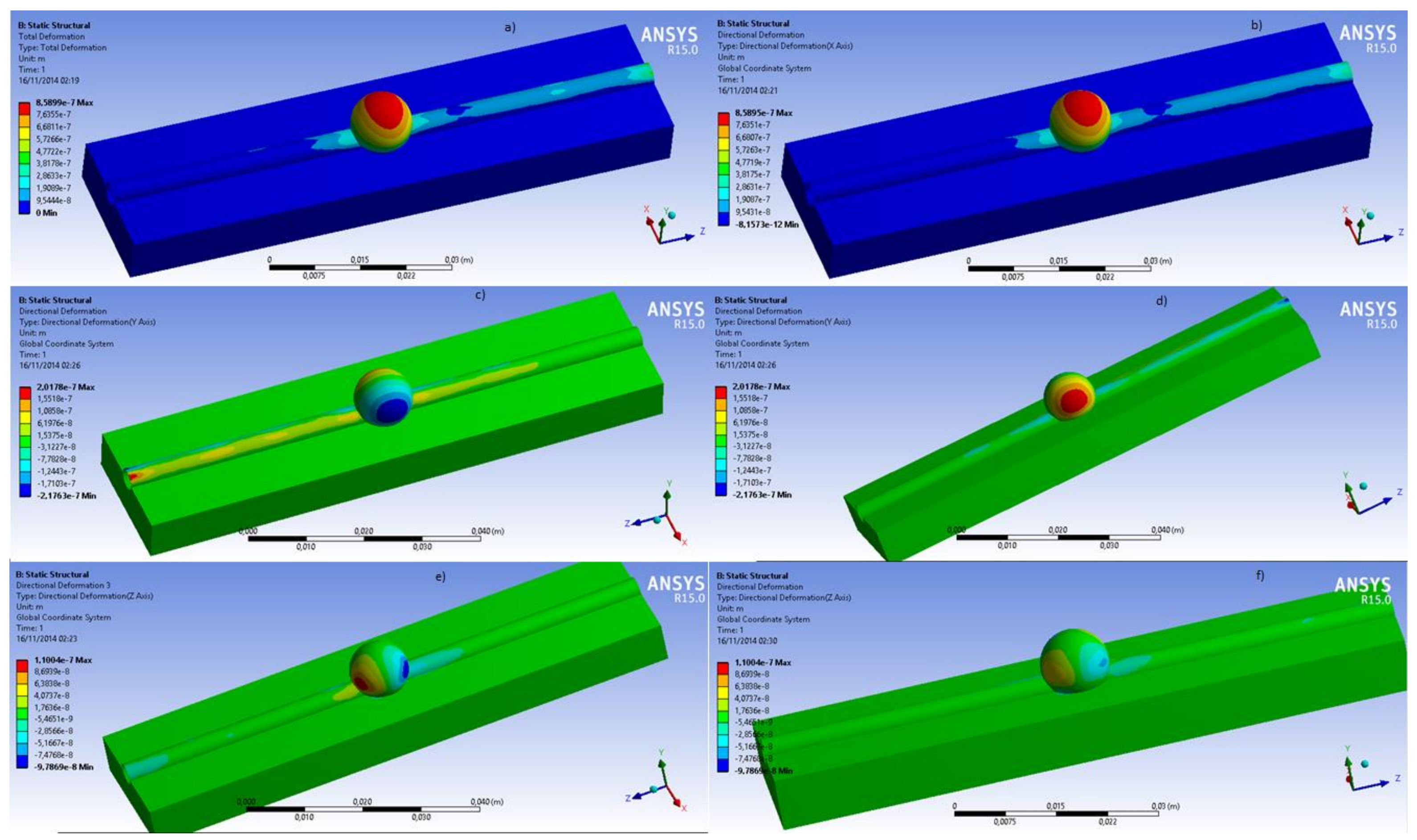

Figure 6 - Displacement field in the channel with aneurysm: a) total displacement; b) in the X direction; c) in the direction Y; d) in Y direction seen in the other side; e) in the direction Z; f) in Z direction seen in the other side.

In the Fig. 7 is presented the total and the Euclidean strain field components.

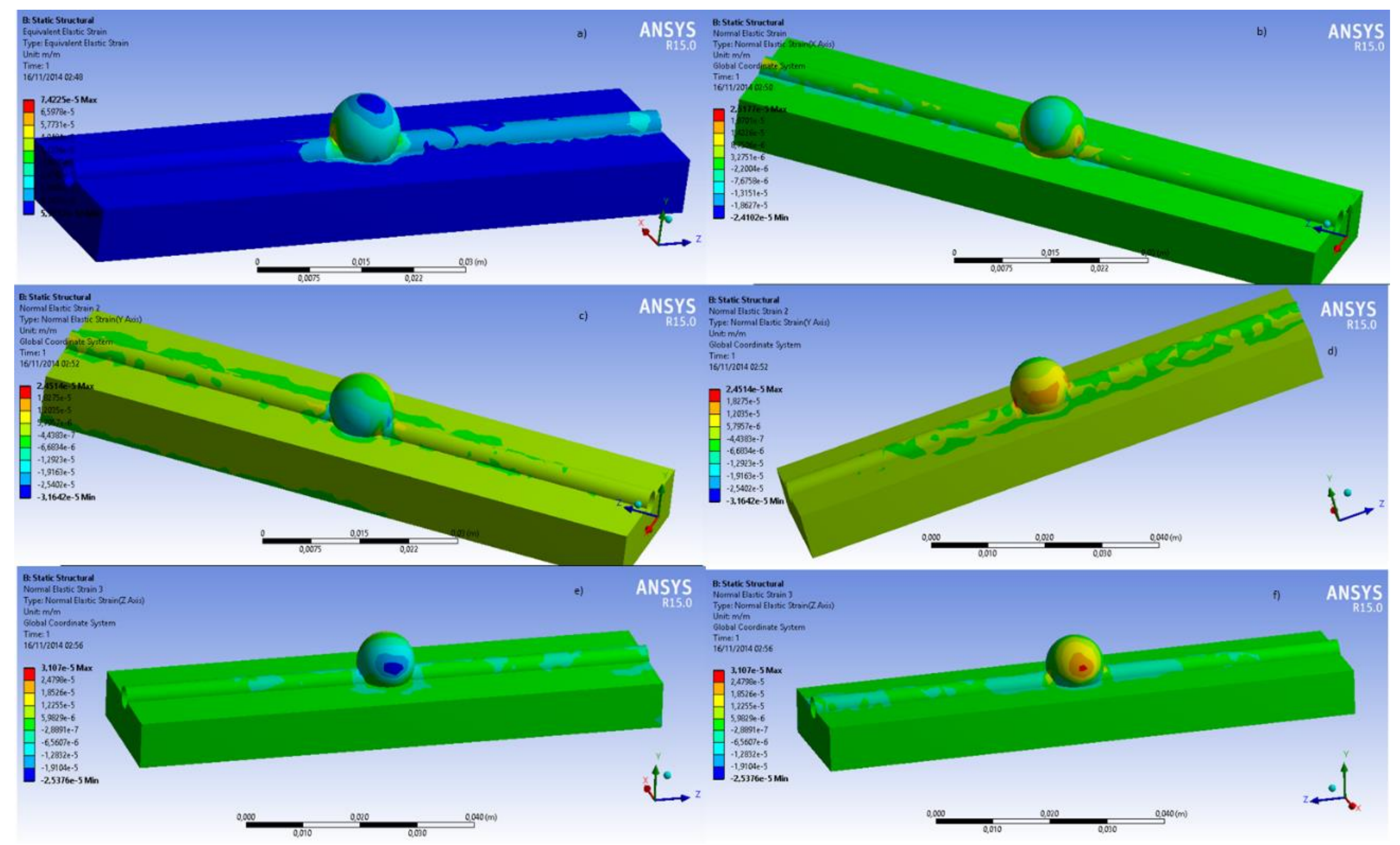

Figure 7 - Strain field of the channel with aneurysm: a) Total strain; b) in the X direction; c) in the direction Y; d) in Y direction (seen from opposite side); e) in the Z direction; f) in the Z direction (seen in from opposite side).

4- CONCLUSIONS

Observing the velocity profile obtained from the numerical simulation it is concluded that the velocity increase from zero on the wall until the maximum into the center channel. If one looks at fluid flow, it is observed that the flow is laminar over the channel. However, in the aneurysm region there is a change in the flow conditions, passing from laminar to turbulent flow.

Analyzing the results, it is apparent that the expansion of the aneurysm is predominant at their lateral regions and, for that reason, the greatest strain occur precisely in these areas, being the high risk of rupture.

REFERENCES

Branco G, Miguel J, Goulão A, Maurício JC, Diagnóstico Angiográfico dos Aneurismas Intracranianos: Estudo Sobre a Experiência do Serviço de Neurologia do Hospital Egas Moniz, Acta Médica Portuguesa, 1992, 5, p.515-518.

Masson I, Boutouyrie P, Laurent S, Humphrey JD, Zidi M, Characterization of arterial wall mechanical behavior and stresses from human clinical data, Journal of Biomechanics, 2008, 41(12), p. 2618–2627.

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