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LEMBAR ABSTRAK

Entin Hartini, Roziq Himawan, Mike Susmikanti., *Fracture Mechanics Uncertainty Analysis In The Reliability Assessment Of The Reactor Pressure Vessel: (2D) Subjected To Internal Pressure*., Jurnal Teknologi Reaktor Nuklir TRI DASA MEGA, 18 (2), 55.

The reactor pressure vessel (RPV) is a pressure boundary in the PWR type reactor which serves to confines radioactive material during chain reaction process. The integrity of the RPV must be guaranteed either in a normal operation or accident conditions. In analyzing the integrity of RPV, especially related to the crack behavior which can introduce break to the reactor pressure vessel, a fracture mechanic approach should be taken for this assessment. The uncertainty of input used in the assessment, such as mechanical properties and physical environment, becomes a reason that the assessment is not sufficient if perfomed only by deterministic approach. Therefore, the uncertainty approach should be applied. The aim of this study is to analize the uncertainty of fracture mechanics calculations in evaluating the reliability of PWR`s reactor pressure vessel. Random character of input quantity was generated using probabilistic principles and theories. Fracture mechanics analysis is solved by Finite Element Method (FEM) with MSC MARC software, while uncertainty input analysis is done based on probability density function with Latin Hypercube Sampling (LHS) using python script. The output of MSC MARC is a J-integral value, which is converted into stress intensity factor for evaluating the reliability of RPV's 2D. From the result of calculation it can be concluded that the SIF from probabilistic method, reached the limit value of fracture toughness earlier than SIF from deterministic method. The SIF generated by the probabilistic method is 105.240 MPa $m^{0.5}$. Meanwhile, the SIF generated by deterministic method is 100.876 MPa $m^{0.5}$.
Keywords: Uncertainty analysis, fracture mechanics, LHS, FEM, reactor pressure vessels

Sri Sudadiyo, Jupiter Sitorus Pane**.,** *Desain Awal Turbin Uap Tipe Aksial Untuk Konsep RGTT30 Berpendingin Helium.,* Jurnal Teknologi Reaktor Nuklir TRI DASA MEGA, 18 (2), 65.

Konsep reaktor daya nuklir yang dikembangkan merupakan jenis reaktor berpendingin gas dengan temperatur tinggi (RGTT). Gas yang digunakan untuk mendinginkan teras RGTT adalah helium. Konsep RGTT ini dapat menghasilkan daya termal 30 MW_{th} sehingga dinamakan RGTT30. Temperatur helium mampu mencapai 700 °C ketika keluar dari teras RGTT30 dan digunakan untuk memanaskan air di dalam steam generator hingga mencapai temperatur 435 °C. Steam generator dihubungkan dengan turbin uap yang dikopel dengan generator listrik untuk membangkitkan daya 7,27 MW_e. Uap yang keluar dari turbin dilewatkan kondensor untuk mencairkan uap menjadi air. Rangkaian komponen dari steam generator, turbin, dan kondensor dinamakan sistem turbin uap. Turbin terdiri dari sudu-sudu yang dimaksudkan untuk mengubah tenaga uap kedalam tenaga mekanis berupa putaran. Efisiensi turbin merupakan parameter yang harus diperhatikan dalam sistem turbin uap ini. Tujuan dari makalah ini adalah untuk mengusulkan sudu tipe aksial dan untuk menganalisa perbaikan efisiensi turbin. Metode yang digunakan yaitu aplikasi prinsip termodinamika yang berhubungan dengan konservasi energi dan massa. Perangkat lunak Cycle-Tempo dipakai untuk mendapatkan

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parameter termodinamika dan untuk mensimulasikan sistem turbin uap berbasis RGTT30. Pertama, dibuat skenario dalam simulasi sistem turbin uap untuk mengetahui efisiensi dan laju aliran massa uap yang diperoleh nilai optimal 87,52 % dan 8,759 kg/s pada putaran 3000 rpm. Kemudian, turbin uap diberi sudu tipe aksial dengan diameter tip 1580 mm dan panjang 150 mm. Hasil yang diperoleh adalah nilai efisiensi turbin uap naik menjadi 88,3 % pada putaran konstan (3000 rpm). Penambahan nilai efisiensi turbin sebesar 0,78 % menunjukkan peningkatan kinerja RGTT30 secara keseluruhan.
Kata kunci: Tipe aksial, turbin uap, RGTT30

Ignatius Djoko Irianto., *Design And Analysis Of Helium Brayton Cycle For Energy Conversion System Of RGTT200K.,* Jurnal Teknologi Reaktor Nuklir TRI DASA MEGA, 18 (2), 75.

The helium Brayton cycle for the design of cogeneration energy conversion system for RGTT200K have been analyzed to obtain the higher thermal efficiency and energy utilization factor. The aim of this research is to analyze the potential of the helium Brayton cycle to be implemented in the design of cogeneration energy conversion system of RGTT200K. Three configuration models of cogeneration energy conversion system have been investigated. In the first configuration model, an intermediate heat exchanger (IHX) is installed in series with the gas turbine, while in the second configuration model, IHX and gas turbines are installed in parallel. The third configuration model is similar to the first configuration, but with two compressors. Performance analysis of Brayton cycle used for cogeneration energy conversion system of RGTT200K has been done by simulating and calculating using CHEMCAD code. The simulation result shows that the three configuration models of cogeneration energy conversion system give the temperature of thermal energy in the secondary side of IHX more than 800 ^{o}C at the reactor coolant mass flow rate of 145 kg/s. Nevertheless, the performance parameters, which include thermal efficiency and energy utilization factor (EUF), are different for each configuration model. By comparing the performance parameter in the three configurations of helium Brayton cycle for cogeneration energy conversion systems RGTT200K, it is found that the energy conversion system with a first configuration has the highest thermal efficiency and energy utilization factor (EUF). Thermal efficiency and energy utilization factor for the first configuration of the reactor coolant mass flow rate of 145 kg/s are 35.82% and 80.63%.
Keywords: Helium Brayton cycle, RGTT200K, Energy conversion system, EUF, Efficiency,

Mike Susmikanti, Roziq Himawan, Abdul Hafid, Entin Hartini., *Evaluation On Mechanical Fracture Of PWR Pressure Vessel And Modeling Based On Neural Network.,* Jurnal Teknologi Reaktor Nuklir TRI DASA MEGA, 18 (2), 87.

The important component of the PWR is a pressure vessel. The material resistance in the pressure vessel needs to be evaluated. One way of evaluation is by the mechanical fracture analysis. The modeling needs to know the phenomena of the analysis result in general. A number of researches have been completed on the calculation of mechanical fracture in the pressure vessel with an internal load. The mechanical fracture was modeled using a neural network approach. In relation to the material resistance of the pressure vessel, which is used in PWR AP1000, the material must be evaluated because of the effect of the load. The modeling is needed to predict the effect of the load. The aim of this study is to evaluate the material resistance through mechanical fracture analysis because of the influence load on the pressure vessel on PWR AP1000. The material, which was observed, is SA 508. This analysis consists of the calculation of stress intensity factor and J-integral with some load at the crack propagation position. The fracture mechanic was analyzed by finite element simulation. The result of Stress Intensity factor and J-Integral was compared with fracture toughness to know the durability of the material. The modeling of J-Integral and Stress Intensity Factor were obtained for some load based on neural network approach.
Keywords: Material resistance, mechanical fracture, neural network, PWR, pressure vessel, crack propagation.

Jati Susilo, Jupiter Sitorus Pane., *Fuel Burn-Up Distribution And Transuranic Nuclide Contents Produced At The First Cycle Operation Of AP1000.,* Jurnal Teknologi Reaktor Nuklir TRI DASA MEGA, 18 (2), 101

AP1000 reactor core was designed with nominal power of 1154 MWe (3415 MWth), operated within life time of 60 years and cycle length of 18 months. For the first cycle, the AP1000 core uses three kinds of UO_2 enrichment, they are 2.35 w/o, 3.40 w/o and

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4.45 w/o. Absorber materials such as ZrB_2, Pyrex and Boron solution are used to compensate the excess reactivity at the beginning of cycle. In the core, U-235 fuels are burned by fission reaction and produce energy, fission products and new neutron. Because of the U-238 neutron absoption reaction, the high level radioactive waste of heavy nuclide transuranic such as Pu, Am, Cm and Np are also generated. They have a very long half life. The purpose of this study is to evaluate the result of fuel burn-up distribution and heavy nuclide transuranic contents produced by AP1000 at the end of first cycle operation (EOFC). Calculation of ¼ part of the AP1000 core in the 2 dimentional model has been done using SRAC2006 code with the module of COREBN/HIST. The input data called the table of macroscopic crossection, is calculated using module of PIJ. The result shows that the maximum fuel assembly (FA) burn-up is 27.04 GWD/MTU, that is still lower than allowed maximum burn-up of 62 GWD/MTU. Fuel loading position at the center/middle of the core will produce bigger burn-up and transuranic nuclide than one at the edges the of the core. The use of IFBA fuel just give a small effect to lessen the fuel burn-up and transuranic nuclide production.
Keywords: Fuel Burn-Up, Transuranic, AP1000, EOC, SRAC2006.

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