# Analysis of the riser suspension performance

**E.V. Avdeev[1], V.L. Polonsky[2], K.A. Volkova[2]**

[1]Samara National Research University, Moskovskoe Shosse 34A, Samara, Russia, 443086
[2]Peter the Great St. Petersburg Polytechnic University, Polytechnicheskaya 29, Saint-Petersburg, Russia, 195251

**Abstract.** This article will consider the design of the riser suspension with mounting on the platform body (unlike the previous one, which was suspended from the ceiling in the hold). The purpose of this study is to assess the performance of the riser suspension, and in particular rubber-metal pillows. The assessment will be carried out without taking into account the first group of factors (without taking into account the deviation of the riser from the vertical axis), taking into account the second group of factors – the impact of the weight of the riser and the weight of the drilling fluid.

## 1. Introduction

Currently, the development of offshore oil and gas fields is an urgent task, the solution of which is associated with the implementation of technically complex and risky operations, with the use of expensive equipment.

When mining on floating platforms, a sea riser (riser) is used, which is one of the most important and responsible nodes of the General complex of underwater wellhead equipment [1].

The purpose of a offshore riser is reflected in the following definition: a riser is a conduit connecting an underwater well, a support plate for drilling or a pipeline to equipment located on a floating oil production plant or a stationary offshore structure [3].

Riser is attached to the mining platform by means of suspension. The reliability of this technical system depends on both the safety of the riser itself and the operation of the production platform as a whole, as well as the environmental safety of the production area.

This article will consider the design of the riser suspension with mounting on the platform body (unlike the previous one, which was suspended from the ceiling in the hold). This option facilitates the operation and maintenance of the suspension and riser.

During operation, the suspension is experiencing the following main effects:

1) effects of wind, waves and sea currents;

2) the weight of the riser and the weight of the drilling mud [2].

## 2. Method description

The purpose of this study is to assess the performance of the riser suspension, and in particular rubber-metal pillows. The assessment will be carried out without taking into account the first group of factors (without taking into account the deviation of the riser from the vertical axis), taking into account the second group of factors – the impact of the weight of the riser and the weight of the drilling fluid.

Let us consider in more detail the design of the suspension, a General view of which is shown in figure 1.These guidelines, written in the style of a submission to *J. Phys.: Conf. Ser.*, show the best layout for your paper using Microsoft Word. If you don't wish to use the Word template provided, please use the following page setup measurements.

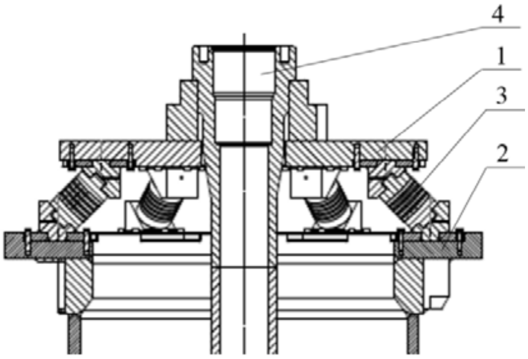


**Figure 1.** General view of the riser suspension (1 – top plate, 2 – bottom plate, 3 – pillow, 4 – riser).

The main damping elements of the suspension are cushions consisting of alternating rubber and metal plates (figure 2).

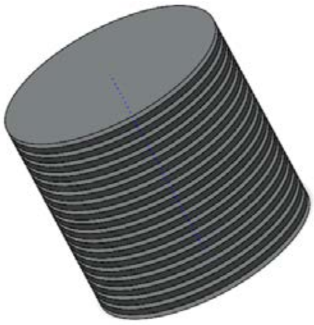

**Figure 2.** Riser suspension cushion.

SolidWorks was used to perform the analysis. For the calculation was built a simplified model of the suspension and set the following conditions (figure 3):

– nonlinear study types, which is suitable for large deformations of hyperelastic materials such as rubbers;

– static type of study that is used to calculate displacement, reaction force, load, stress, and safety margin distribution;

– the load simulating the weight of the riser and the weight of the drilling mud 2000кН;

– material of suspension plates and metal plates of pillows-chrome stainless steel ( $\sigma_B$ = 414 Mpa);

– material of rubber plates of pillows-rubber ( $\sigma_B$ = 13,8 MPa, $\delta$ = 2,5).

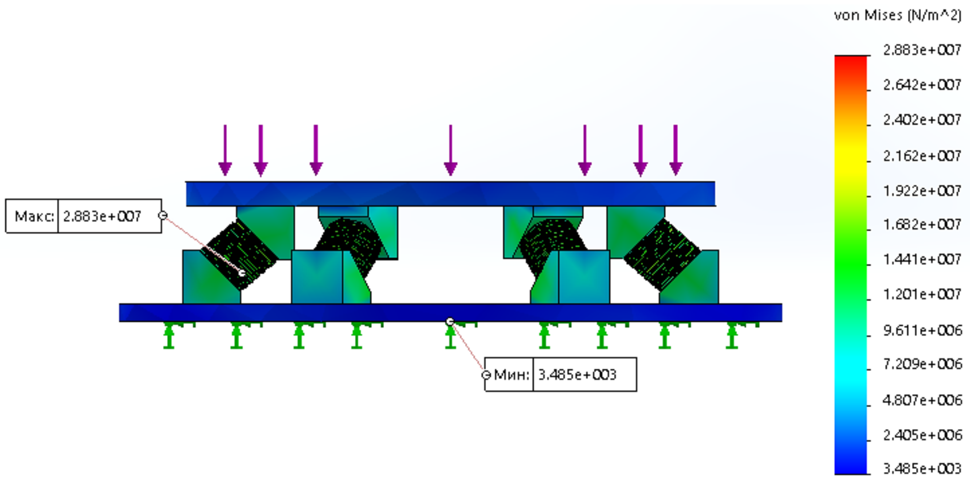


**Figure 3.** Suspension loading model.

As a result of the calculations the greatest operating stresses are found ($\sigma_{vonMises}$) who are experiencing pillows, they amounted to 29 MPa.

Taking into account the incompressibility of rubber, the true stress ($\sigma_{ucm}$) at which the instantaneous destruction of the material in question is determined by formula 1.

$$\sigma_{ucm} = \sigma_B (1 + \delta), \tag{1}$$

where $\sigma_B$ tensile strength, $\delta$ - elongation.

Calculate the true stress using formula 1 (formula 2).

$$\sigma_{ucm} = 13.8\ (1+2.5) = 48.3 \text{ MPa} \tag{2}$$

In order to draw a conclusion about the performance of the suspension – compare the obtained using the SolidWorks software value of the maximum effective voltage ($\sigma_{vonMises}$ = 29 Mpa) in the pillows with the calculated formula 1 value of the true voltage ($\sigma_{ucm}$ = 48.3 MPa).

Since the maximum operating voltage is 40% less than the failure voltage, the following conclusion can be drawn: the suspension must withstand the specified loads.

**3. References**

[1] Bulatov, A. Technology of drilling oil and gas wells: Studies. for students on special. 170200 "Machines and equipment of oil and gas fields" / A.I. Bulatov, Yu.M. Proselkov, S.A. Shamans. – M.: Nedra - Biznestsentr publ., 2003. – 1006 p.

[2] Galakhov, I.N. Floating drilling platforms. The design and strength / I.N. Galakhov, O.E. Limonov, A.A. Aliseychik. – L.: Shipbuilding, 1981.

[3] The underwater riser system: a guide for the construction and classification. – American Bureau of shipping, 2004.