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Discussions

Interactive comment on "Study on Mechanical Properties and Dissipation Capacity of Ring Net in Passive Rockfall Barriers" *by* Chengqing Liu et al.

Chengqing Liu et al.

lcqjd@swjtu.edu.cn

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Dear Referee, Thank you for your comments concerning our manuscript entitled "Study on Mechanical Properties and Dissipation Capacity of Ring Net in Passive Rockfall Barriers" (Manuscript Number: nhess-2018-76). The main corrections in the paper and the responds to your comments are as follows:

The manuscript does not make a significant contribution to the understanding of a natural hazard. It mainly deals with one element of a rockfall barrier. In the manuscript a single ring of a net with its deformation properties is analyzed. Response: The passive flexible protection system is mainly used to prevent falling rock disasters and protect people's life and propertyïijŇin this paper, we analyzed the mechanical properties and

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Discussion paper

energy dissipation of the ring network in the overall protective structure. Firstly, the energy dissipation formula of a single ring is calculated, and then extended to the entire ring network. It is expected to provide certain theoretical basis and guidance for the design of the overall protective structure.

In the abstract it is promised that this ring will be exposed to a twoâĂŘpoint, a fourâĂŘ-point and a six point stress and these results will be confirmed by experiments. Such results for all three loads cannot be found in the manuscript. Response: The formula of the single ring under the twoâĂŘpoint, a fourâĂŘpoint and a six- point stress was pushed forward and compared with the experimental data in the literature to verify the correctness of the formula.

The introduction should be better structured and should be focused on the title of the manuscript. It does not make sense to describe the simulations of complex rockfall barrier if in the title is mentioned "ring net" and in the manuscript only one single ring is analysed under special conditions. Response: Numerical simulation is mentioned in the introduction to illustrate the research status, and we first calculated the energy dissipation formula of a single ring and then extended to the entire ring network.

In the theoretical part, the single ring is treated as one element. In reality, however, a ring can be made of different materials (wire bundles, ropes, etc.). The properties of the material used are decisive for the deformation properties of a ring. The manuscript does not address these important differences and therefore is of little interest to design engineers. Response: In actual engineering, most of the materials of the ring net are steel, and the ring we studied is mainly R7/3/300.

A small rockfall barrier may have around 500 individual rings which are hung together. Between the individual rings occur forces and deformations, which must be considered in the simulation of ring nets. These constraints and their influence on the results are not dealt with. In the manuscript two types of arrangement of rings in protective nets are drawn. This arrangement is crucial in the deformation of ring nets. The diagonal arrangement produces much more deformation than the orthogonal arrangement. This problem is likewise not addressed by the authors. Response: In this paper, we have studied the constraint conditions. The arrangement of the two types is the problem we need to further study, which is our next research direction.

In a subchapter the influence of the inclination angle of the stone trajectory on the net is simulated. But not the trajectory of the stone is changed, but the inclination of the net. This is fundamentally wrong, since the gravitational force has a smaller influence on the deformation (load) of the ring net in a flatter trajectory. Furthermore, it is shown in a simulation that forces are to be orthogonally removed in diagonally arranged rings in the network Twenty years of testing ringnets in Switzerland, France and Italy show the opposite result. Obviously there is fundamental error in the simulation results. Response: We use the inclination of the ring net to represent the change of the falling rock trajectory. Different falling rock trajectories have different consumption of falling rock energy, with the increase of the impact angle, the destruction method of the ring net is the fracture of the central ring at the connection of the lower support rope.

The introduction is a collection of work done with ring nets and complete rockfall barrier. The simulations of complete protection nets should be omitted and describe the work with ring nets better and more detailed. Response: The simulations of complete protection nets is mentioned in the introduction to illustrate the research status, and we mainly write about the work of the ring nets.

Line 40: In Figure 3 (a) a ring net is shown with orthogonally arranged rings and in figure 4 (a) one with diagonal arranged rings. The different behavior should be explained in the manuscript. Response: Thank you for your good advice. Although there are two types of arrangements, the energy dissipation performance of a single ring is not affected.

Line 43: In Spadari et al. (2012) no ring nets are treated but wire mesh. Therefore, this reference should be omitted. Response: Thank you for your good advice. We have omitted it.

Line 46: Thoeni et al. (2013) Also in this publication wire meshs are simulated and therefore this reference does not contribute to a better understanding of ring nets. Omit. Response: Thank you for your good advice. We have omitted it.

Line 99: The terms EF and CD are to be explained in the text or otherwise omitted. Response: Thank you for your good advice. We have revised it in the paper, the point F has been removed.

Line 106: Why are δ and θ not drawn in Fig. 5? Please perform. Response: Thank you for your good advice. δ=BF, we have revised it in the paper.

Line 109: In the whole manuscript must be more clearly distinguished, where a single wire (in the manuscript translated as "coils") and where a ring with many wires is meant. The translation of a single wire with "coil" is wrong. Response: Thank you for your good advice. We have revised it in the paper.

Line 124: The remarks added above should apply mutatis mutandis to Chapter 2.2. Response: Thank you for your good advice. I describe it in Chapter 2.1, and we use the same method for energy calculation in Chapter 2.2.

Line 147: Also in chapter 2.3 the values δ and θ are not shown. Response: Thank you for your good advice. θ has been shown in chapter 2.3, δ is the radial displacement variation under tension load on diameters.

Line 171: The results presented in chapter 2.4 can't be verified because the mentioned China internal publications are not publicly available. Response: Thank you for your good advice. However, we did not see relevant experimental data in other literatures.

Line 180: With the simple principles presented in the previous chapters, the simulation (Chapter 3) of the experiments (Grassl et al., 2002) can't be explained. In a simulation must be specified with what forces the rings are attached. Depending on the height of the forces occur larger or smaller deformations of the ring net. Also, the friction between the rings has an influence on the deformation. These points are not discussed. The results of the simulation (displacement, acceleration, impact time) will be presented and the simulation itself will not be described. Above all, in fig.6 the single ring is loaded orthogonally and diagonally in the simulation. Response: Thank you for your good advice. We simplified the model during the simulation and assumed it was in an ideal state. he arrangement of the two types is the problem we need to further study, which is our next research direction.

Line 208: The individual rings are orthogonally interconnected in Fig. 11, although the ring R7/ 3/300 has never been so arranged. The rings should be drawn as in Fig. 10. It should also be indicated how many rings are actually installed. Response: Thank you for your good advice. This section mainly studies the influence of boundary conditions on the passive protective net, and the number of rings is useless.

Line 213: In the simulation with the three boundary conditions, indicate how much the rope is tensioned. In addition, I find it an impertinence for the reader that he should read the results himself from Figures 12 and 13. It is the task of the author to show and explain his results in detail. Here I expect next to the diagrams also a table with the results about the deformation and the braking time of the three simulations. Response: Thank you for your good advice. We have revised it in the paper.

Line 220: A mass of 830 kg at a velocity of 7 m / s produces a kinetic energy of 20.3 kJ and not a value between 16âĂŘ20 kJ as shown in Figure 13. Here in Fig. 13, there must be an obvious error. In addition, the position of the mass must be taken into account in an energy analysis. It would be better to represent the energy of the mass with respect to the greatest deformation. In addition to the representation of the deformation, the speed and the deceleration could also be displayed. These additional diagrams would make the simulation more transparent. Response: Thank you for your good advice. We simplified the model during the simulation and assumed it was in an ideal state. Therefore, the numerical simulation energy will be less.

Line 231: The specification of the maximum energy with two decimal places are exaggerated. Here are integer values. Response: Thank you for your good advice. We have revised it in the paper.

Line 239: If the influence of the angle of incidence α is to be investigated in this chapter, then the trajectory of the mass should also be changed in this sense and not the ring net as shown in Fig. 16 should be rotated. The results will certainly be different, because the influence of gravitational acceleration decreases with increasing angle Response: Thank you for your good advice. We use the inclination of the ring net to represent the change of the falling rock trajectory, and the acceleration of gravity is decomposed along the Angle direction

Line 265: The theoretical basics and simulations described in this chapter are extrapolated from the single ring to a net with 6 * 12 rings (Fig.17). At the edge of the rings are attached to ropes and in the ropes energy is reduced. This aspect is not mentioned. It is only claimed that the difference of the energy of the numerical simulation and the theoretical calculation is only 0.71%. Response: Thank you for your good advice. In practical engineering, the ropse need consume energy, but we assume in the simulation that the ropes are completely rigid and does not consume energy, at this time, energy is consumed by the ring net..

Line 290: Why are not both energies (bending and tensile) added together in the two stripes? Please explain. Response: Thank you for your good advice. The length of the transverse strip region is longer, the force on the distant ring is smaller, and it may not enter the plastic stage, while the vertical strip region is more stressed, the ring is easy to enter the plastic stage, so it is assumed that the rings in the vertical strip region all reach plastic deformation, the bending deformation energy of the rings in the transverse strip region, we do the calculations separately, and then we add them up.

Line 321: The correctness of the theoretical results is not confirmed for rings with 6 adjacent rings. Response: Thank you for your good advice. To a certain extent, the results are acceptable.

Line 323: The presented numerical model can't be used to model a complete protection net with supports and ropes, but only a part of a ring net which is stored under certain conditions. Response: Thank you for your good advice. This manuscript mainly studies the energy consumption of a single ring and a ring nets , the numerical simulation is mainly aimed at the ring net, in order to provide a reference for the design of the passive protective nets.

Line 326: It is not the trajectory inclination that has been changed, but the position of the(horizontal) ring net. Therefore, the results should be interpreted with caution. Response: Thank you for your good advice. We use the inclination of the ring net to represent the change of the falling rock trajectory and the acceleration of gravity is decomposed along the Angle direction, to a certain extent, the results are acceptable.

Line 330: Passive protective nets against falling rocks as shown in Fig. 2 and Fig.3 consist of substantially more elements than described in this manuscript. The most important element of modern safety nets are the brake elements installed in the ropes to limit the forces. Response: Thank you for your good advice. Fig.2 and fig.3 are just for people to have a visual understanding of the passive protective net, and I introduced the composition of the passive protective net in the manuscript.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-76/nhess-2018-76-AC3-supplement.zip

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