

## 西北工业大学

## 2008 年博士研究生第二次招生考试试题

试题名称: (3047) 力学专业综合 (A)

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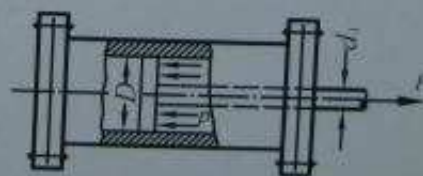
说明: 所有试题一律写在答题纸上

## 一、专业英语翻译 (30 分)

As it was discussed in Lecture 2, due to finite strength of materials, there is always a small *damaged zone* around the crack tip. For metals, this damaged zone is referred to as the *crack tip plastic zone*. If the size of the plastic zone is small enough that it can be contained within the *K*-dominant region, we may use *K* and *G* as the LEFM parameters. This condition is also referred to as the *small-scale-yielding* condition (SSY). On the other hand, if this zone is larger than the *K*-dominant region, then our linear elastic assumptions are not correct, i.e., LEFM is not applicable and nonlinear models must be used. Figure 1 shows three different situations regarding the spread of crack tip plastic zone. The first one represents the SSY condition. The second one shows the situation when the crack tip plastic zone is large enough to cause some nonlinearity in the overall response of the component. However, if this nonlinearity is not very significant, it can be handled with a *non-linear elastic* model, for which we will introduce a non-linear-elastic energy release rate called *J*, usually known as the *J*-Integral. However, we should note that, similar to the LEFM, there is a limit to the validity of *J* with regard to the size of the plastic zone compared to the *J*-dominant region.

## 二、计算题 (70 分)

1、(20 分) 卧式拉床的油缸内径  $D=186\text{mm}$ , 活塞杆直径  $d_1=65\text{mm}$ , 材料为 20Cr 并经过热处理,  $[\sigma_{Cr}]=130\text{MPa}$ 。缸盖由 6 个 M20 的螺栓与缸体联接, M20 螺栓的内径  $d=17.3\text{mm}$ , 材料为 35 号钢, 经热处理后  $[\sigma_{35}]=110\text{MPa}$ 。试按活塞杆和螺栓强度确定最大油压  $p$ 。



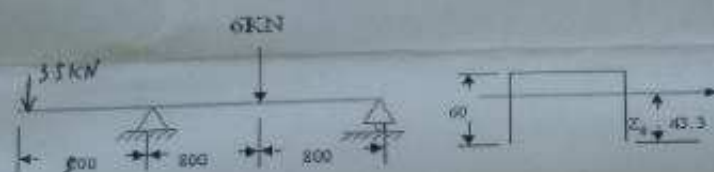
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2. (20 分) 一外伸梁如图所示, 梁为 N014b 槽钢制成, 试求梁的最大拉应力和最大压应力。已知  $I_z = 61.6 \text{ cm}^4$ ,  $z_0 = 43.3 \text{ mm}$ 。



3. (20 分) 单摆悬线长  $L$ , 摆锤质量为  $m$ , 使摆锤由对铅直线微小偏离  $\theta_0$  处无初速释放, 试求单摆微小摆动的规律。



4. (10 分) 简述目前国际力学发展状况