**1-2. Stress Concentration of A Plate with Hole**

1. Compare maximum stress and deformation for the two cases. (plate length 300mm, height 120mm, thickness 30mm)

|  |  |  |
| --- | --- | --- |
|  | Case1 | Case2 |
| Maximum normal stress | 6.1003 MPa | 5.8619 MPa |
| Maximum equivalent  (Von-Mises) stress | 5.9662 MPa | 5.7361 MPa |
| Maximum deformation | mm | mm |

Table . Comparison between Case 1 and Case 2

* In terms of Maximum normal stress and Maximum equivalent (Von-Mises) stress, Case1 is about 2MPa larger than Case2. But, In terms of Maximum deformation, Case 1 is about mm lesser than Case 2.
* There is also a difference in the value of the stress concentration factor K. The stress concentration factor can be obtained using the following equation.

K = ,

|  |  |  |
| --- | --- | --- |
|  | Case 1 | Case 2 |
|  |  |  |
| K |  |  |

Table . Stress-concentration factor

* 두 물체의 길이, 높이, 두께는 동일하므로 는 같다. 하지만, 최대 응력은 다르므로 집중응력계수는 차이가 난다. Case 1의 최대 응력이 Case 2보다 더 크므로 Case 1의 집중응력계수가 더 큰 것을 Table 2를 통해 확인할 수 있다.
* Since the two objects have the same length, height, and thickness, is the same. However, since the maximum stress is different, the concentration stress factor is different. As the maximum stress of Case 1 is higher than that of Case 2, it could be verified from Table 2 that the concentrated stress factor of Case 1 is larger.

1. Which of the design will you select from an analysis standpoint?

* Case1 has greater maximum stress than Case2, but the maximum deformation is smaller. Case1 objects and Case2 objects have the same length, height, and thickness. The maximum stress under the same conditions is about 2 MPa less in Case2 than in Case1. This means that Case 2 receives relatively less force, and the concentration of force is lower than Case 1. Therefore, from an analysis standpoint, Case 2 will be selected by determining that Case 2 will be safer.
* Case1이 Case2보다 최대 응력이 더 크지만 최대 변형률 차이는 미세하다. Case1과 Case2 물체의 길이, 높이, 두께는 동일한 조건이다. 동일한 조건에서의 최대 응력이 Case1보다 Case2가 약 2MPa 작다. 이 말은 Case2가 상대적으로 힘을 덜 받는다는 얘기이며, 힘의 집중도가 Case1보다 낮다는 것을 의미한다. 따라서, 분석적인 관점에서는 Case2가 더 안전할 것으로 판단하여 Case2를 선택할 것이다.

1. Which of the design will you select from a manufacturing standpoint?

* Case 1 has fewer holes than Case 2. Although the maximum stress is higher in Case 1, it offers the advantage of being easier and more cost-effective to manufacture since it requires less hole processing. Additionally, because of the difference in the number of holes, the design of Case 1 is simpler than Case 2, which reduces production time, allowing for the production of more items. Although there is a subtle difference in maximum deformation between the two objects, if I have to compare those, Case 1 has less deformation than Case 2, making it safer from a deformation perspective. Therefore, from a manufacturing standpoint where factors such as cost and production time and others are crucial, Case 1 would be the preferred choice.
* Case 1이 Case 2보다 구멍개수가 더 적다. 비록 최대 응력은 Case 2보다 더 크지만, 구멍 가공을 적게 할 수 있으므로 만들기 쉽고, 비용도 절감할 수 있다는 장점이 있다. 또한, 디자인도 더 간단해서 생산 시간이 단축되므로 더 많은 물건을 만들 수 있다. 비록, 두 물체 간의 최대 변형의 차이는 미세하지만, 그래도 Case 1 변형이 더 적게 일어나므로 변형 관점에서도 더 안전하다고 할 수 있다. 제조업의 입장에서는 물건을 만들어내는 일이기 때문에 비용, 생산시간 등을 고려하므로 Case 1을 선택할 것이다.