Autodesk® Moldflow 2021

Automatic Packing Pressure Profile

Executive summary

This report is about the implementation of automatic packing. It gives an introduction, and then describes example cases.

Contents

AUTODESK.

Introduction

In Autodesk Moldflow 2021, the feature of automatic packing is added. It is available for mid-plane, Dual-Domain and 3D thermoplastics molding processes in both Autodesk Moldflow Insight and Autodesk Moldflow Adviser. It will calculate packing time and packing pressure automatically (without extra user input data). The automatic packing profile is meant to provide a reasonable packing profile which will produce good quality parts for user who have not yet determined the actual processing conditions of their molding. The objective of the automatic profile is to achieve low volumetric shrinkage values throughout the majority of the part. The automatic packing profile is not intended to a be the absolute optimum packing profile. It is expected that users will be able to determine better packing profiles by manual or automatic optimization processes.

The “Automatic” packing option is added to the “Pack/holding” control options as shown in Figure 1.

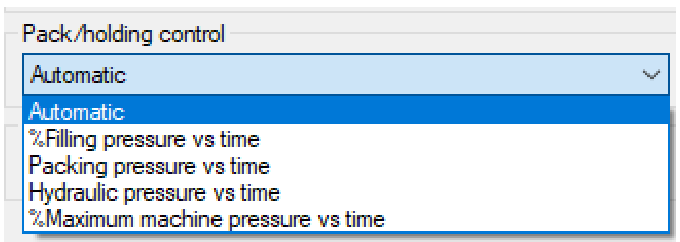


Figure 1: Pack/holding control option that includes “Automatic” option.

The packing time used for automatic packing is determined as follows. The initial estimate for the packing time is made at V/P switch-over (usually this is an over-estimate of the actual packing time required). The actual packing time is determined by calculating the rate of change of part mass. If the rate of change becomes small enough, packing will end.

The packing pressure level is determined at V/P switch-over and maintained at a constant value during packing. The packing pressure is determined as follows. First, the upper limit of pressure is determined as the smaller of the following:

0.8 * Maximum machine injection pressure

0.8 * (Maximum clamping force / projected area)

The packing pressure is then determined from V/P switch-over pressure and the upper limit pressure.

(1) If the switch-over pressure is higher than the upper limit pressure, the packing pressure is set to the upper limit pressure.

(2) If the switch-over pressure is lower than the upper limit pressure, the packing pressure is determined using the upper limit pressure and V/P switch-over pressure. When the V/P switch-over pressure is very low compared to the upper limit pressure, a packing pressure which is higher than the V/P switch-over pressure will be used.

Example Cases

Some case studies will be shown to demonstrate the outcomes of automatic packing.

Case Study 1

The first case study is a 3D analysis of a gear cog. The material used is a POM. The mold temperature was 60ºC, the initial melt temperature was 190ºC, and the fill time was approximately 2 sec.

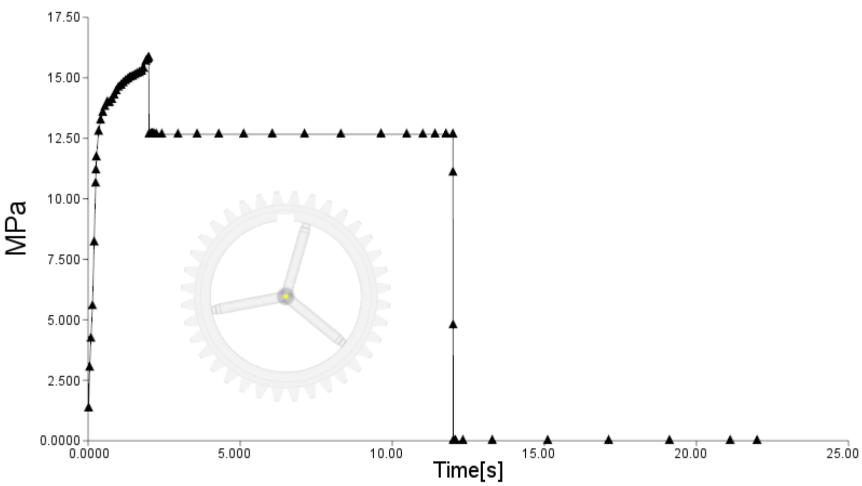
For this case, the traditional default packing profile (80% of filling pressure) is (as shown in Figure 2(a)):

Packing time = 10 sec; Packing pressure = 12.7 MPa

The packing profile determined for automatic packing is (as shown in Figure 2(b)):

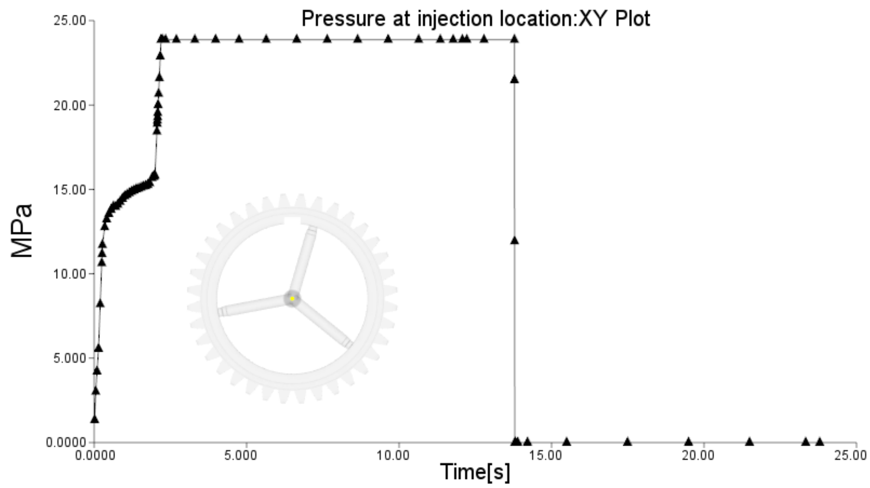
Packing time = 11.6 sec; Packing pressure = 23.9 MPa

The packing time from automatic packing is longer than that from the default packing. The calculated warpage results are shown in Figure 3. The deflection values are slightly lower with automatic packing than with default packing.



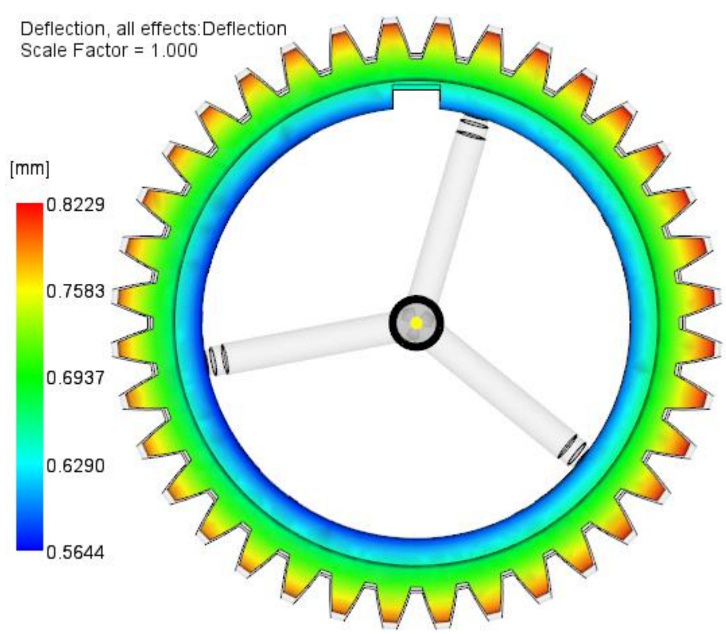
(a)

AUTOMATIC PACKING PRESSUE PROFILE

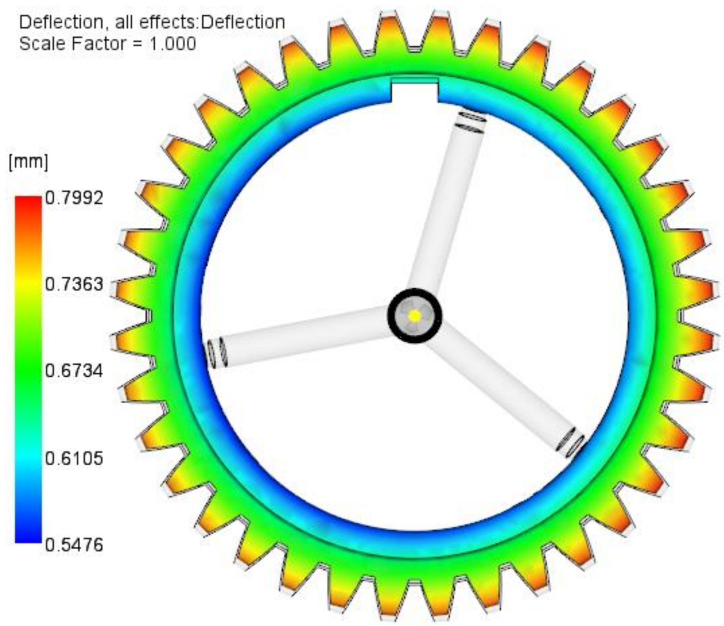


(b)

Figure 2: Pressure at injection location XY plot: (a) default packing (b) automatic packing.



(a)



(b)

Figure 3: Calculated warpage results: (a) default packing, (b) automatic packing.

Case Study 2

The second case study is a 3D analysis of thin lenses. The material used is PMMA. The mold temperature was 70ºC, the initial melt temperature was 235ºC, and the fill time was approximately 1 sec.

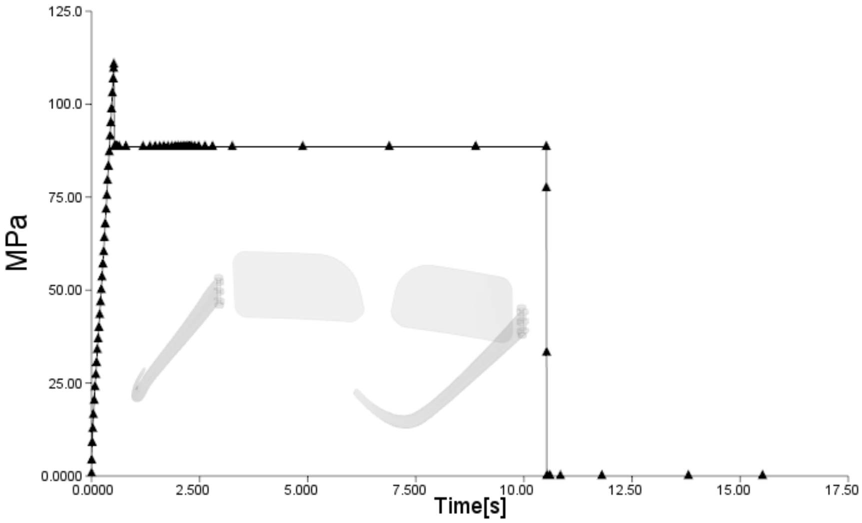
For this case, the traditional default packing profile is (as shown in Figure 4(a)):

Packing time = 10 sec; Packing pressure = 88.6 MPa

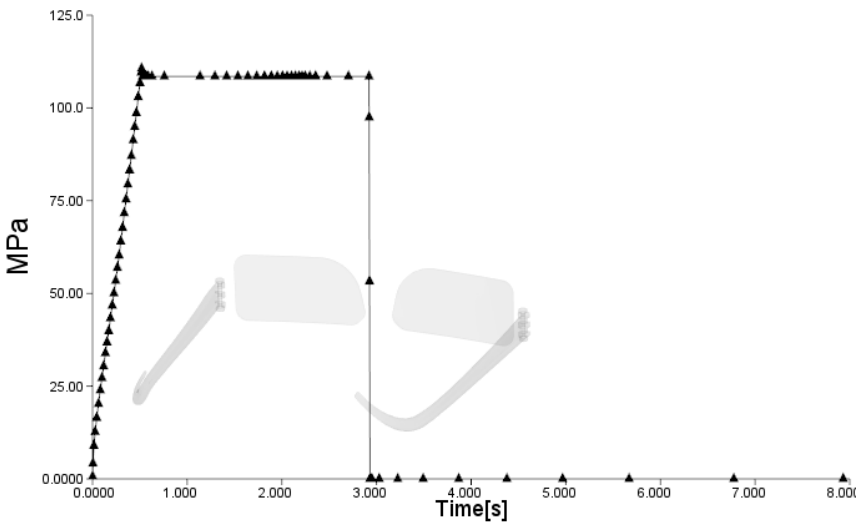
The packing profile determined for automatic packing is (as shown in Figure 4(b)):

Packing time = 2.40 sec; Packing pressure = 108.5 MPa

The packing time from automatic packing is much shorter than that from the default packing method. The calculated warpage results are shown in Figure 5. The deflection values are lower with automatic packing than with default packing.

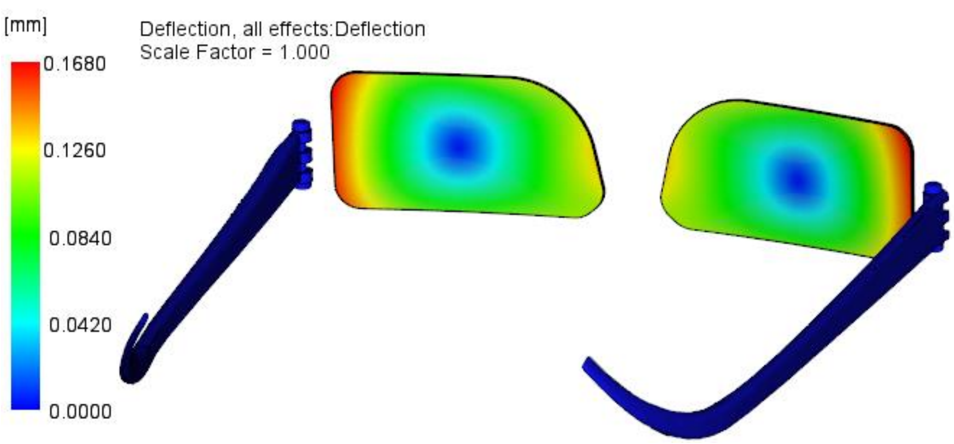


(a)

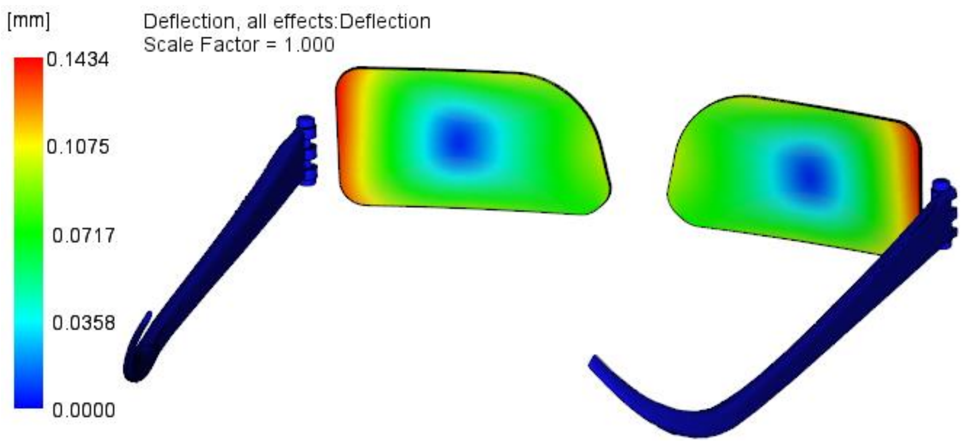


(b)

Figure 4: Pressure at injection location XY plot: (a) default packing (b) automatic packing.



(a)



(b)

Figure 5: Calculated warpage results: (a) default packing, (b) automatic packing.

Case Study 3

The third case study is a 3D analysis of a part with thick wall sections. The material used is PP. The mold temperature was 50ºC, the initial melt temperature was 220ºC, and the fill time was approximately 0.6 sec.

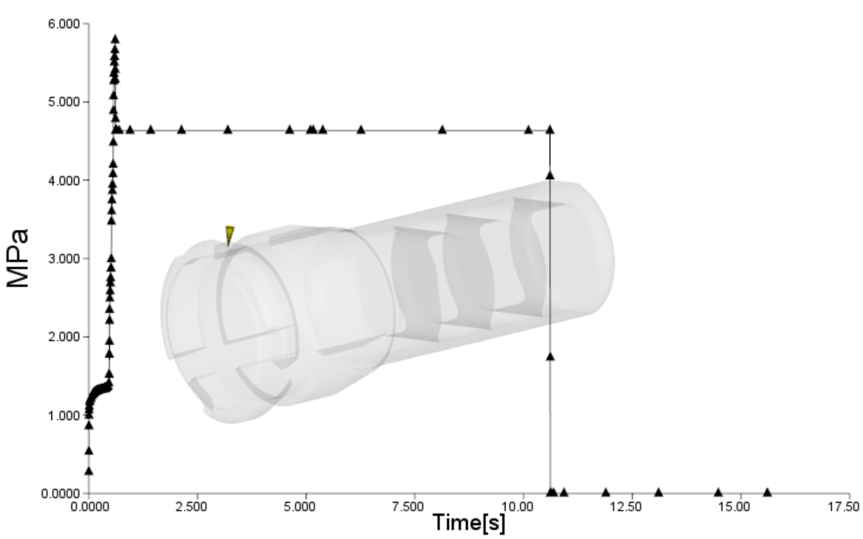
For this case, the traditional default packing profile is (as shown in Figure 6(a)):

Packing time = 10 sec; Packing pressure = 4.632 MPa

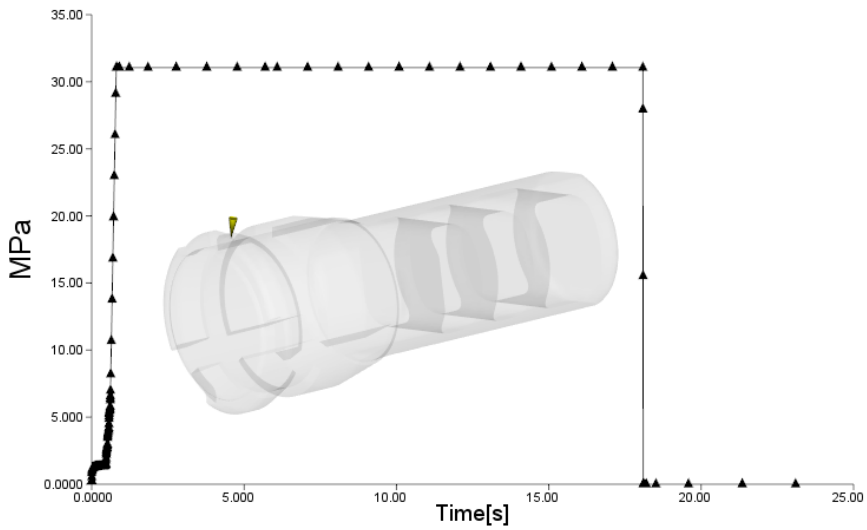
The packing profile determined for automatic packing is (as shown in Figure 6(b)):

Packing time = 17.48 sec; Packing pressure = 31.05 MPa

The packing time from automatic packing is much longer than that from default packing method. The calculated warpage results are shown in Figure 7. The deflection values are lower with automatic packing than with default packing.

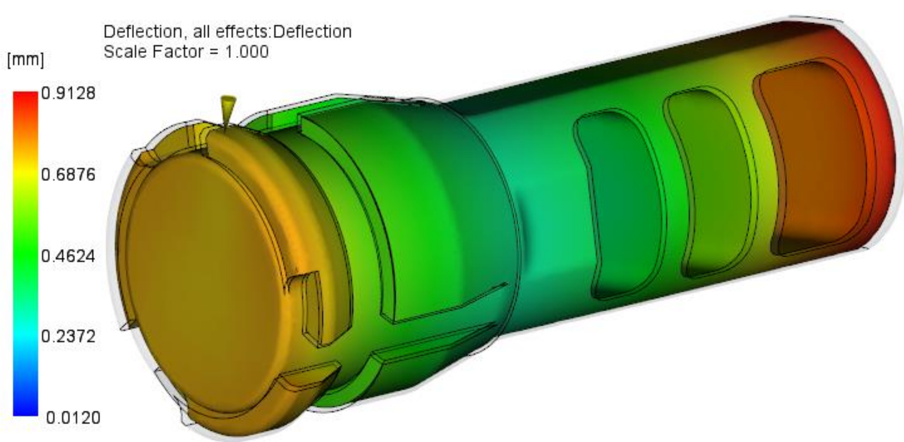


(a)

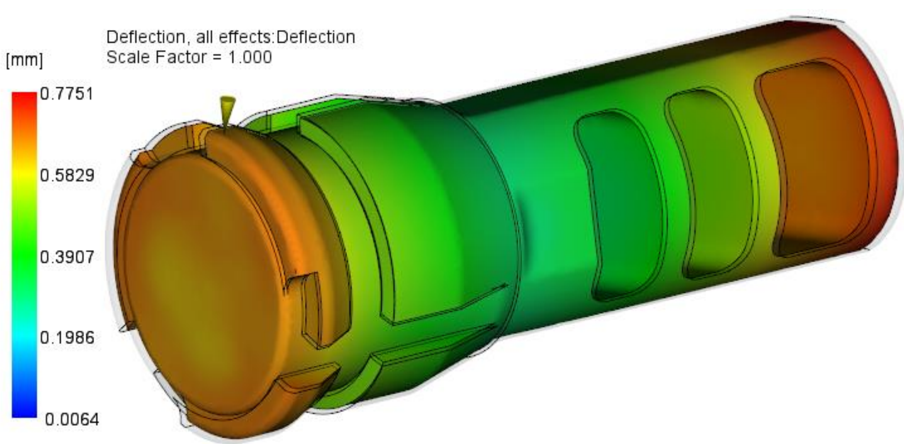


(b)

Figure 6: Pressure at injection location XY plot: (a) default packing (b) automatic packing.



(a)



(b)

Figure 7: Calculated warpage results: (a) default packing, (b) automatic packing.

Case Study 4

The fourth case study is a Dual-Domain analysis of the gear cog. The material is POM. The mold temperature was 60ºC, the initial melt temperature was 190ºC, and the fill time was approximately 2 sec.

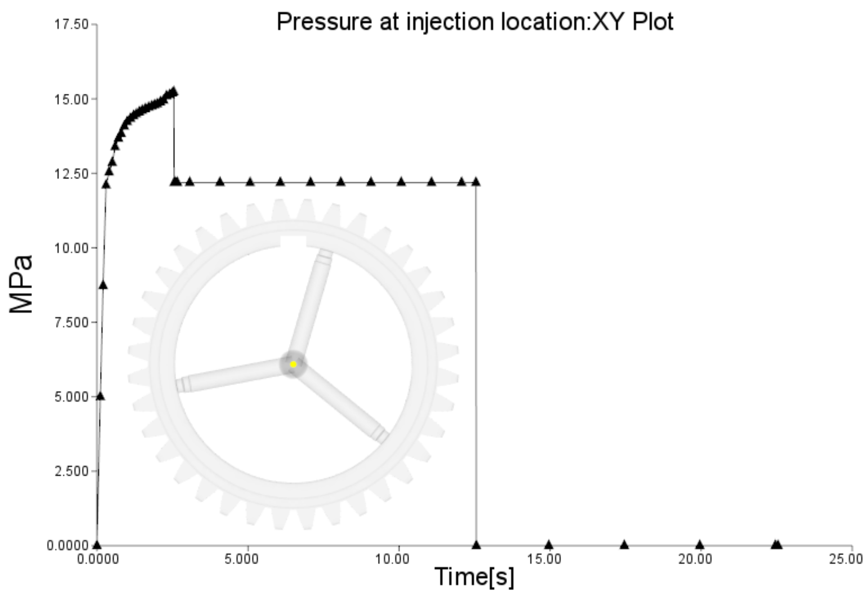
For this case, the traditional default packing profile is (as shown in Figure 8(a)):

Packing time = 10 sec; Packing pressure = 12.18 MPa

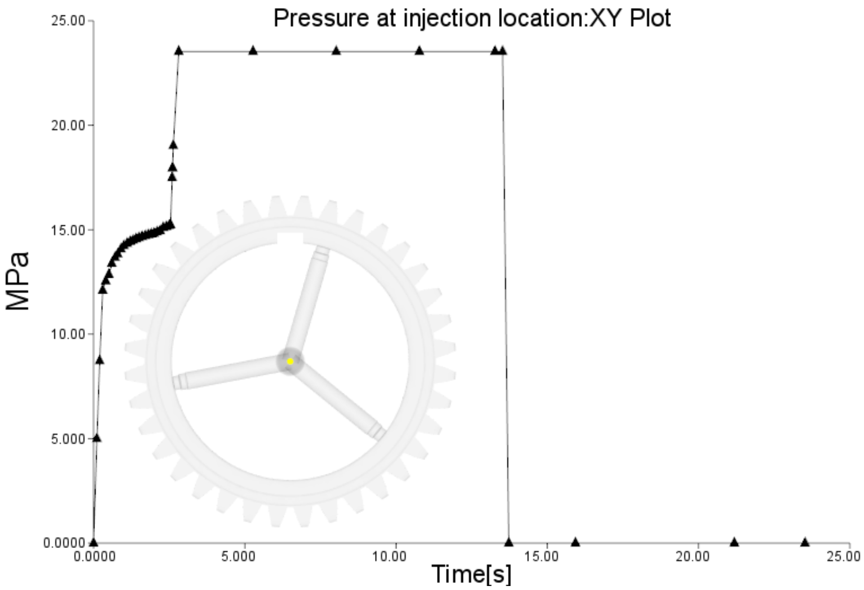
The packing profile determined for automatic packing is (as shown in Figure 8(b)):

Packing time = 10.98 sec; Packing pressure = 23.53 MPa

As can be seen, the packing time from automatic packing is slightly longer than the default packing profile. The calculated warpage results are shown in Figure 9. The deflection values are slightly lower with automatic packing than with default packing.

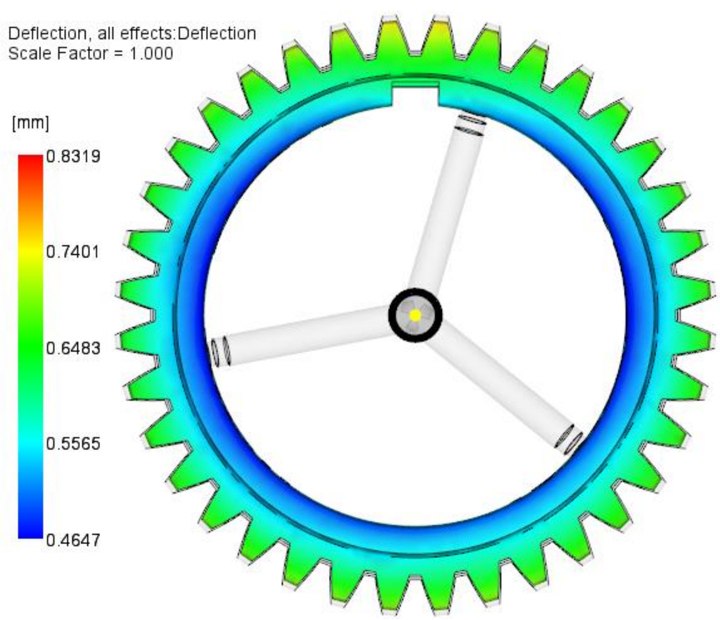


(a)

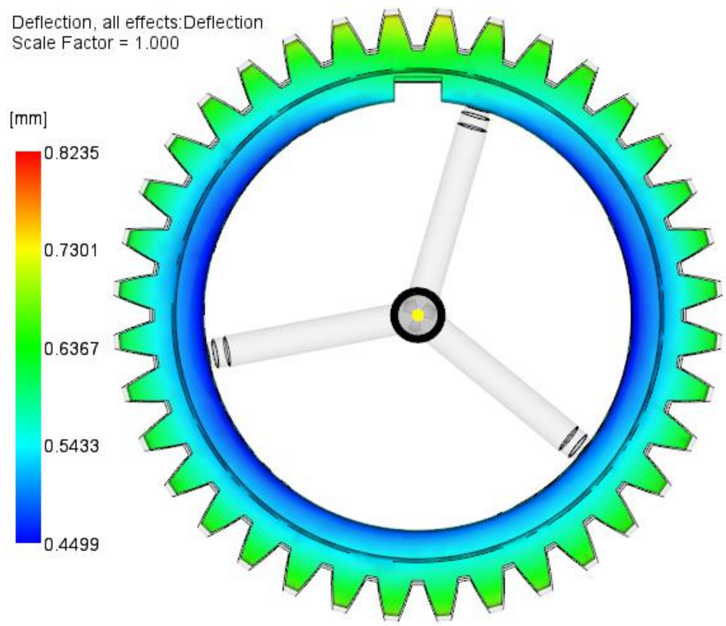


(b)

Figure 8: Pressure at injection location XY plot: (a) default packing (b) automatic packing.



(a)



(b)

Figure 9: Calculated warpage results: (a) default packing, (b) automatic packing.