延时模拟与单点模拟的比较研究

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**摘要**：本研究的目的是比较epanet2.dll延时模拟与单点模拟对韧性分析的影响。

# 问题描述

# 理论与材料

# 案例分析



图1 案例anytown管网模型

表1 工况1破坏信息

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 破坏编号 | 所在管线编号 | 该管线上破坏破坏次序 | 破坏点与前点之间长度比例 | 破坏类型 | 渗漏面积等效直径（mm） |
| 1 | 1 | 1 | 0.57385 | 1 | 93.8367 |
| 2 | 2 | 1 | 0.42783 | 1 | 60.4781 |
| 3 | 2 | 2 | 0.30561 | 1 | 60.4781 |
| 4 | 2 | 3 | 0.25301 | 1 | 60.4781 |
| 5 | 8 | 1 | 0.24775 | 1 | 55.2087 |
| 6 | 12 | 1 | 0.92498 | 1 | 143.3042 |
| 7 | 19 | 1 | 0.43155 | 1 | 76.6174 |
| 8 | 27 | 1 | 0.41899 | 1 | 49.3802 |
| 9 | 30 | 1 | 0.63965 | 1 | 55.2087 |

表2 工况2破坏信息

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 破坏编号 | 所在管线编号 | 该管线上破坏破坏次序 | 破坏点与前点之间长度比例 | 破坏类型 | 渗漏面积等效直径（mm） |
| 1 | 1 | 1 | 0.057168 | 1 | 60.4781 |
| 2 | 6 | 1 | 0.41752 | 1 | 55.2087 |
| 3 | 9 | 1 | 0.36287 | 1 | 55.2087 |
| 4 | 9 | 2 | 0.54571 | 1 | 55.2087 |
| 5 | 11 | 1 | 0.59679 | 1 | 49.3802 |

表3 工况2破坏信息

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 破坏编号 | 所在管线编号 | 该管线上破坏破坏次序 | 破坏点与前点之间长度比例 | 破坏类型 | 渗漏面积等效直径（mm） |
| 1 | 1 | 1 | 0.005252 | 1 | 60.4781 |
| 2 | 2 | 1 | 0.36959 | 1 | 60.4781 |
| 3 | 11 | 1 | 0.49238 | 1 | 49.3802 |
| 4 | 12 | 1 | 0.398 | 1 | 55.2087 |
| 5 | 21 | 1 | 0.79558 | 1 | 49.3802 |
| 6 | 22 | 1 | 0.99464 | 2 | 0 |
| 7 | 26 | 1 | 0.079287 | 1 | 55.2087 |
| 8 | 35 | 1 | 0.56471 | 2 | 0 |
| 9 | 36 | 1 | 0.25084 | 2 | 0 |
| 10 | 39 | 1 | 0.021766 | 1 | 76.6174 |
| 11 | 113 | 1 | 0.9143 | 1 | 143.3042 |

表4 工况4破坏信息

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 破坏编号 | 所在管线编号 | 该管线上破坏破坏次序 | 破坏点与前点之间长度比例 | 破坏类型 | 渗漏面积等效直径（mm） |
| 1 | 18 | 1 | 0.25597 | 2 | 0 |
| 2 | 18 | 2 | 0.23106 | 1 | 85.6608 |
| 3 | 20 | 1 | 0.63332 | 1 | 114.6433 |
| 4 | 28 | 1 | 0.32457 | 1 | 60.4781 |
| 5 | 29 | 1 | 0.26511 | 1 | 60.4781 |
| 6 | 35 | 1 | 0.46006 | 1 | 55.2087 |
| 7 | 39 | 1 | 0.50548 | 1 | 49.3802 |
| 8 | 41 | 1 | 0.26372 | 1 | 85.6608 |
| 9 | 110 | 1 | 0.14184 | 1 | 55.2087 |
| 10 | 113 | 1 | 0.60518 | 1 | 85.6608 |
| 11 | 125 | 1 | 0.39413 | 1 | 55.2087 |
| 12 | 125 | 2 | 0.2269 | 1 | 55.2087 |

表5 工况5破坏信息

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 破坏编号 | 所在管线编号 | 该管线上破坏破坏次序 | 破坏点与前点之间长度比例 | 破坏类型 | 渗漏面积等效直径（mm） |
| 1 | 6 | 1 | 0.53602 | 1 | 55.2087 |
| 2 | 6 | 2 | 0.25372 | 1 | 85.6608 |
| 3 | 7 | 1 | 0.007751 | 1 | 93.8367 |
| 4 | 7 | 2 | 0.92691 | 2 | 0 |
| 5 | 8 | 1 | 0.53589 | 1 | 55.2087 |
| 6 | 17 | 1 | 0.12207 | 1 | 49.3802 |
| 7 | 17 | 2 | 0.07341 | 1 | 49.3802 |
| 8 | 22 | 1 | 0.54114 | 1 | 49.3802 |
| 9 | 34 | 1 | 0.27729 | 1 | 55.2087 |
| 10 | 41 | 1 | 0.97579 | 1 | 143.3042 |
| 11 | 110 | 1 | 0.48106 | 1 | 55.2087 |

# 计算结果

表 6 各次模拟的韧性值

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 模拟工况 | 延时模拟 | 高点单点模拟 | 低点单点模拟 | 模拟时长(h) |
| 1 | 0.76859242 | 0.950898145548249 | 0.950898294559861 | 152 |
| 2 | 1.0210794 | 0.940937501782026 | 0.940937650793638 | 120 |
| 3 | 0.83239990 | 0.864121055757781 | 0.864121204769393 | 290 |
| 4 | 0.77754974 | 0.958821884835220 | 0.958822033846832 | 287 |
| 5 | 0.72001338 | 0.967391788632795 | 0.967391937644407 | 222 |



图 工况1条件下每个时间点的供水能力



图 3 工况1条件下每个时间点工作管道长度比例

# 讨论

# 结论

延时模拟与单点模拟之间韧性差距较大，不能采用单点模拟代替延时模拟进行韧性计算。

# 致谢

感谢侯老师的督促，我在时隔两个月后重新对该报告进行了完善和总结。