西 南 交 通 大 学

本科毕业设计

源代码

|  |  |  |
| --- | --- | --- |
| 设计 |  |  |
| 复核 |  |  |
| 审核 |  |  |

二〇二二年五月

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# 网页前端代码

1.1 index.html

<!doctype html>

<html lang="en" class="no-js">

<head>

  <meta charset="UTF-8" />

  <title>扶壁式挡土墙稳定性检算系统</title>

  <meta name="viewport" content="width=device-width, initial-scale=1.0">

  <link rel="stylesheet" href="css/style.css" />

  <link href='http://fonts.googleapis.com/css?family=Montserrat:400,700' rel='stylesheet' type='text/css'>

  <script type='text/javascript' src='js/jquery.particleground.min.js'></script>

  <script type='text/javascript' src='js/particles.js'></script>

</head>

<body id="particles">

<div>

  <div id="intro">

    <h1>扶壁式挡土墙稳定性检算系统</h1>

    <p>用代码解放双手</p>

    <!-- <p>A JavaScript plugin for snazzy background particle systems</p> -->

    <a href="./input.html" class="btn">开始</a>

  </div>

</div>

</body>

</html>

## 1.2 input.html

<!doctype html>

<html lang="en" class="no-js">

<head>

    <meta charset="UTF-8" />

    <title>扶壁式挡土墙稳定性检算系统</title>

    <meta name="viewport" content="width=device-width, initial-scale=1.0">

    <link rel="stylesheet" href="css/bootstrap-combined.min.css" />

    <link rel="shortcut icon" type="image/x-icon" href="img/favicon.ico">

    <script type='text/javascript' src='js/jquery-1.11.1.min.js'></script>

    <script type='text/javascript' src='js/input.js'></script>

    <script type = 'text/javascript' async src = 'js/plotly.min.js'></script>

    <script type="text/x-mathjax-config">

        MathJax.Hub.Config({

            showProcessingMessages: false,

            messageStyle: "none",

            extensions: ["tex2jax.js"],

            jax: ["input/TeX", "output/HTML-CSS"],

            tex2jax: {

                inlineMath:  [ ["$", "$"] ],

                displayMath: [ ["$$","$$"] ],

                skipTags: ['script', 'noscript', 'style', 'textarea', 'pre','code','a'],

                ignoreClass:"comment-content"

            },

            "HTML-CSS": {

                availableFonts: ["STIX","TeX"],

                showMathMenu: false

            }

        });

        MathJax.Hub.Queue(["Typeset",MathJax.Hub]);

        </script>

        <script async src="js/MathJax.js?config=TeX-AMS-MML\_HTMLorMML"></script>

</head>

<style type="text/css">

    body {

        background: #f8f8f7;

        font-family: 'Montserrat', sans-serif;

        /\* color: #fff; \*/

        line-height: 1.3;

        -webkit-font-smoothing: antialiased;

        position:relative;

    }

    td{

     padding: 5px;

    }

    #quad {

        margin-top: 30px;

    }

    legend {

        font-weight: 1000;

        /\* color: #fff; \*/

    }

    .btn-block{

    width: 30%;

    }

    #footer{

    line-height: 1.15;

    -webkit-tap-highlight-color: rgba(0,0,0,0);

    -webkit-text-size-adjust: 100%;

    text-rendering: optimizeLegibility;

    -webkit-font-smoothing: antialiased;

    box-sizing: border-box;

    outline: 0;

    display: block;

    position: relative;

    clear: both;

    text-align: center;

    font-size: 1.2rem;

    font-weight: 400;

    font-family: Consolas,Menlo,Monaco,"lucida console","Liberation Mono","Courier New","andale mono",monospaceX,monospace,sans-serif;

    padding: 1.25rem 0;

    background-color: #3a3737cc;

    transition: 0.5s ease all;

    margin-right: -10px;

    margin-left: -10px;

    width: calc(100% - -20px);

    color: #f0f0f0;

    margin-top: 41px;

    }

    .center{

        padding-left: 35%;

        padding-top: 20px;

    }

    .tips {

        display: none;

        border-radius: 10px;

        padding: 20px;

        position: relative;

    }

    #img\_chi {

        width: 100%;

    }

    #show\_po\_div{

        display: none;

    }

    .btn-success {

        color: #fff;

        background-color: #38b03f;

        border-color: #329d38;

    }

    .btn-danger {

    color: #fff;

    background-color: #ea644a;

    border-color: #e75033;

}

.success{

    color: #38b03f;

}

.danger{

    color: #e75033;

}

.btn-lg {

    padding: 10px 16px;

    font-size: 16px;

    line-height: 1.25;

    border-radius: 4px;

}

#mask{

    display: none;

}

#result\_show{

    display: none;

}

#result\_show tr:hover{

    background-color: #cdf1cf;

}

#stress\_chart{

    width: 480;

    height: 450;

    overflow: hidden;

}

</style>

<body>

    <div id="mask">

        <div id="shade" style=" background: rgba(0,0,0,0.8); position: absolute; top: 0px; left: 0px; z-index: 300; height: 100%; width: 100%;"></div>

        <img async src="img/loading.gif" style="position: fixed; top: 20%; left: 40%; z-index: 300; height: 30%">

    </div>

    <div class="container">

        <div class="row">

            <div class="span6">

                <fieldset>

                    <legend>挡土墙几何数据 <i class="help"><svg t="1649146043722" viewBox="0 0 1024 1024" version="1.1"

                                xmlns="http://www.w3.org/2000/svg" p-id="2212" data-spm-anchor-id="a313x.7781069.0.i1"

                                width="20" height="20">

                                <path

                                    d="M512 1024C229.216 1024 0 794.752 0 512 0 229.216 229.216 0 512 0 794.752 0 1024 229.216 1024 512 1024 794.752 794.752 1024 512 1024ZM473.28 826.752 551.328 826.752 551.328 747.488 473.28 747.488 473.28 826.752ZM655.008 243.616C618.88 211.84 571.584 196 512.96 196 457.696 196 412.064 212.16 376.096 244.448 340.16 276.736 319.808 320.384 315.072 375.392L396.288 375.392C407.968 297.536 445.568 275.392 512.224 275.392 546.368 275.392 575.584 269.12 596.672 290.144 617.792 311.136 628.352 337.856 628.352 370.304 628.352 386.912 624.448 402.688 616.704 417.472 608.896 432.288 588.96 453.536 556.896 481.152 524.8 508.768 502.816 534.816 490.88 559.232 478.944 583.616 472.832 616.768 472.832 669.216L551.616 669.216C551.616 629.44 550.176 606.304 557.952 589.216 565.728 572.192 586.688 549.248 620.832 520.48 655.008 491.712 678.272 465.504 690.624 441.792 702.944 418.112 709.152 392.448 709.152 364.8 709.152 315.712 691.104 275.296 655.008 243.616Z"

                                    p-id="2213" fill="#707070" data-spm-anchor-id="a313x.7781069.0.i0" class="selected">

                                </path>

                            </svg></i></legend>

                    <table id="design\_table" align="left" cellpadding="1" cellspacing="1" style="width: 500px;">

                        <tbody>

                            <tr>

                                <td><label h="">挡土墙高度H：<input id="H" placeholder="单位为m" type="text"  onchange="check\_limit(this,6,10)"></label></td>

                                <td><label h="">挡土墙每节长度L：<input id="L" placeholder="单位为m" type="text"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">趾板高度H2：<input id="H2" placeholder="单位为m" type="text"></label></td>

                                <td><label h="">扶壁宽度B\_fb：<input id="B\_fb" placeholder="单位为m" type="text"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">趾板近墙面板侧高度Hzd：<input id="Hzd" placeholder="单位为m" type="text"></label>

                                </td>

                                <td><label h="">单节扶壁墙扶壁数量num\_fb：<input id="num\_fb" placeholder="单位为个"

                                            type="text"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">墙踵板高度H3：<input id="H3" placeholder="单位为m" type="text"></label></td>

                                <td onclick="change\_BT()"><label h="">是否设凸榫：<input id="have\_tenon" checked="checked"

                                            type="checkbox"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">趾板宽度B2：<input id="B2" placeholder="单位为m" type="text"></label></td>

                                <td><label h="">凸榫高度HT：<input id="HT" placeholder="单位为m" type="text"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">面板宽度B：<input id="B" placeholder="单位为m" type="text"></label></td>

                                <td><label h="">凸榫宽度BT：<input id="BT" placeholder="单位为m" type="text"></label></td>

                            </tr>

                            <tr>

                                <td><label h="">踵板宽度B3：<input id="B3" placeholder="单位为m" type="text"></label></td>

                                <td><label h="">凸榫外缘距墙趾的距离BT1：<input id="BT1" placeholder="单位为m" type="text"></label>

                                </td>

                            </tr>

                            <tr>

                                <td><label h="">墙趾埋深：<input id="cover\_h" placeholder="单位为m" type="text"></label></td>

                                <td>&nbsp;</td>

                            </tr>

                        </tbody>

                    </table>

                </fieldset>

            </div>

            <div class="span6">

                <div class="tips" id="chi">

                    <img id="img\_chi" alt="挡墙尺寸示意图" src="img/尺寸.svg" />

                </div>

                <canvas id="quad" width="650" height="600" style="background: rgb(248, 248, 247)"></canvas>

            </div>

        </div>

        <div class="row">

            <p></p>

            <p></p>

            <div class="span12">

                <fieldset>

                    <legend>坡线土柱数据 <i id="help\_po"><svg t="1649146043722" viewBox="0 0 1024 1024" version="1.1" xmlns="http://www.w3.org/2000/svg" p-id="2212" data-spm-anchor-id="a313x.7781069.0.i1" width="20" height="20">

                                <path d="M512 1024C229.216 1024 0 794.752 0 512 0 229.216 229.216 0 512 0 794.752 0 1024 229.216 1024 512 1024 794.752 794.752 1024 512 1024ZM473.28 826.752 551.328 826.752 551.328 747.488 473.28 747.488 473.28 826.752ZM655.008 243.616C618.88 211.84 571.584 196 512.96 196 457.696 196 412.064 212.16 376.096 244.448 340.16 276.736 319.808 320.384 315.072 375.392L396.288 375.392C407.968 297.536 445.568 275.392 512.224 275.392 546.368 275.392 575.584 269.12 596.672 290.144 617.792 311.136 628.352 337.856 628.352 370.304 628.352 386.912 624.448 402.688 616.704 417.472 608.896 432.288 588.96 453.536 556.896 481.152 524.8 508.768 502.816 534.816 490.88 559.232 478.944 583.616 472.832 616.768 472.832 669.216L551.616 669.216C551.616 629.44 550.176 606.304 557.952 589.216 565.728 572.192 586.688 549.248 620.832 520.48 655.008 491.712 678.272 465.504 690.624 441.792 702.944 418.112 709.152 392.448 709.152 364.8 709.152 315.712 691.104 275.296 655.008 243.616Z" p-id="2213" fill="#707070" data-spm-anchor-id="a313x.7781069.0.i0" class="selected">

                                </path>

                            </svg></i></legend>

                    <div class="tips" id="img\_po">

                        <img id="img\_chi" alt="挡墙尺寸示意图" src="img/po.png">

                    </div>

                    <div id="show\_po\_div" style="display: block;">

                        <table class="table">

                            <thead>

                                <tr>

                                    <th>坡线水平投影</th>

                                    <th>坡线竖直投影</th>

                                    <th>换算土柱高度</th>

                                    <th>换算土柱宽度</th>

                                    <th>换算土柱距当前坡线起点距离</th>

                                    <th></th>

                                </tr>

                            </thead>

                            <tbody id="show\_po"><tr></tr><tr></tr><tr>

        <td>3</td>

        <td>2</td>

        <td></td>

        <td></td>

        <td></td>

        <td><input type="button" class="btn btn-danger" value="删除此行" onclick="delate(this); draw\_po('quad')"></td>

    </tr><tr>

        <td>5</td>

        <td>0</td>

        <td>3.1</td>

        <td>3.2</td>

        <td>1</td>

        <td><input type="button" class="btn btn-danger" value="删除此行" onclick="delate(this); draw\_po('quad')"></td>

    </tr></tbody>

                        </table>

                    </div>

                    <table>

                        <tbody>

                            <tr>

                                <td><label>坡线水平投影：</label> <input id="po\_h" placeholder="单位为m" type="text"></td>

                                <td><label>坡线竖直投影：</label> <input id="po\_v" placeholder="单位为m" type="text"></td>

                                <td><label>换算土柱高度：</label> <input id="tu\_h" placeholder="没有则不填，单位为m" type="text">

                                </td>

                                <td><label>换算土柱宽度：</label> <input id="tu\_w" placeholder="没有则不填，单位为m" type="text">

                                </td>

                                <td><label>换算土柱距当前坡线起点距离：</label> <input id="tu\_j" placeholder="没有则不填，单位为m" type="text">

                                </td>

                                <td><button class="btn btn-success" onclick="add\_tu(); draw\_po('quad')">添加</button></td>

                            </tr>

                        </tbody>

                    </table>

                </fieldset>

            </div>

        </div>

        <div class="row">

            <p></p>

            <p></p>

            <div class="span12">

                    <fieldset>

                        <legend>参数设置</legend>

                        <table align="left" cellpadding="1" cellspacing="1" style="width: 500px;">

                            <tbody>

                                <tr>

                                    <td><label h="">地基类型：<select id="base\_type">

                                        <option value="a" selected="selected">未风化至弱风化的硬质岩石</option>

                                        <option value="b">除上项以外的其他岩石</option>

                                        <option value="c">基本承载力大于200kPa的土层</option>

                                        <option value="d">除上项以外的其他土层</option>

                                    </select> </label></td>

                                    <td><label h="">地基摩擦系数：<input id="f" type="text" placeholder="无单位"></label></td>

                                    <td><label h="">地基容许应力：<input id="base\_sigma" placeholder="单位为kPa" type="text"></label></td>

                                </tr>

                                <tr>

                                    <td><label h="">墙体重度：<input id="gamma\_wall" placeholder="单位为kN/m^3" type="text"></label></td>

                                    <td><label h="">填土内摩擦角：<input id="phi" placeholder="单位为度" type="text" ></label></td>

                                    <td><label h="">填土重度：<input id="gamma\_soil" placeholder="单位为kN/m^3" type="text"></label></td>

                                </tr>

                                <tr>

                                    <td><label h="">计算精度：<input id="accuracy" placeholder="单位为度" type="text" value = "0.5"></label></td>

                                    <td><label h="">水平地震系数：<input id="k\_H" type="text" placeholder="无单位" ></label></td>

                                    <td><label h="">综合影响因素：<input id="C\_z" placeholder="一般取0.25" type="text" value = "0.25"></label></td>

                                </tr>

                                <tr>

                                    <td><label h="">结构重要性系数：<input id="gamma\_0" placeholder="无单位" type="text" ></label></td>

                                </tr>

                            </tbody>

                        </table>

                    </fieldset>

                    <div class="center"><button onclick="submit\_data\_to\_server()" class="btn btn-block btn-success btn-lg">开始验算</button></div>

            </div>

        </div>

        <hr/>

        <div id="result\_show">

            <h2 class = "center">检算结果</a></h2>

            <div class="row">

                <div class="span6">

                    <fieldset>

                        <legend>基本信息</legend>

                        <table align="left" cellpadding="1" cellspacing="1" style="width: 500px;">

                            <tbody>

                                <tr>

                                    <td >第一破裂面夹角：<span class="result\_text" id = "result\_theta" ></span>$^o$</td>

                                </tr>

                                <tr>

                                    <td ><span id = "result\_have\_2\_plm">第二破裂面夹角：</span><span  class="result\_text" id = "result\_alpha" ></span>$^o$</td>

                                </tr>

                                <tr>

                                    <td >基底宽度：<span  class="result\_text" id = "result\_B" ></span>$m$</td>

                                </tr>

                                <tr>

                                    <td >挡土墙截面积：<span  class="result\_text" id = "result\_area\_G" ></span>$m^2$</td>

                                </tr>

                                <tr>

                                    <td ><span id = "result\_area\_W\_desc">真实墙背与第二破裂面间土体截面积：</span><span  class="result\_text" id = "result\_area\_W" ></span>$m^2$</td>

                                </tr>

                                <tr>

                                    <td ><span id = "result\_area\_W1\_desc">第一破裂面与第二破裂面间土体截面积：</span><span  class="result\_text" id = "result\_area\_W1" ></span>$m^2$</td>

                                </tr>

                                <tr>

                                    <td >总稳定弯矩：<span  class="result\_text" id = "result\_sum\_M\_y" ></span>kN·m</td>

                                </tr>

                                <tr>

                                    <td >总倾覆弯矩：<span  class="result\_text" id = "result\_sum\_M\_0" ></span>kN·m</td>

                                </tr>

                                <tr>

                                    <td >总竖向力：<span  class="result\_text" id = "result\_sum\_N" ></span>kN</td>

                                </tr>

                                <tr>

                                    <td ><a id = "stress\_chart" target="\_blank" >土压力应力分布图</a></td>

                                </tr>

                            </tbody>

                        </table>

                    </fieldset>

                    <fieldset>

                        <legend>受力计算结果</legend>

                        <table cellpadding="1" cellspacing="3" style="width: 500px;">

                            <tbody id = "result\_force">

                                <tr>

                                    <th>名称</th>

                                    <th>大小</th>

                                    <th>水平分力</th>

                                    <th>竖直分力</th>

                                    <th>作用点(墙趾下点为原点)</th>

                                </tr>

                                <tr id="result\_E\_a">

                                    <td >主动土压力$E\_a$</td>

                                </tr>

                                <tr id="result\_G">

                                    <td >挡墙重力G</td>

                                </tr>

                                <tr id="result\_W">

                                    <td >墙踵上土体自重W</td>

                                </tr>

                                <tr id="result\_W\_toe">

                                    <td >墙墙趾上土体自重</td>

                                </tr>

                                <tr id="result\_W1">

                                    <td >滑动体自重$W\_1$</td>

                                </tr>

                                <tr id="result\_G\_p">

                                    <td >挡墙受地震力$G\_p$</td>

                                </tr>

                                <tr id="result\_W\_p">

                                    <td >墙踵上土体受地震力$W\_p$</td>

                                </tr>

                                <tr id="result\_W1\_p">

                                    <td >滑动体受地震力$W\_{1p}$</td>

                                </tr>

                            </tbody>

                        </table>

                    </fieldset>

                </div>

                <div class="span6">

                    <div class = "row" id = "result3d"></div>

                </div>

            </div>

            <div class="row">

                <p></p>

                <p></p>

                <div class="span6">

                        <fieldset>

                            <legend>永久荷载+主可变荷载</legend>

                            <table align="left" cellpadding="1" cellspacing="1" style="width: 500px;">

                                <tbody id="check\_1">

                                    <tr>

                                        <th>检测项目</th>

                                        <th>不安全荷载</th>

                                        <th>安全荷载</th>

                                        <th>检算结果</th>

                                    </tr>

                                    <tr id="result\_K\_c"> <td >滑动稳定性</td></tr>

                                    <tr id="result\_K\_0"> <td >倾覆稳定性</td></tr>

                                    <tr id="result\_e">   <td >偏心距e</td></tr>

                                    <tr id="result\_sigma\_1k"> <td >墙趾处压应力$\sigma\_{1k}$</td></tr>

                                    <tr id="result\_sigma\_2k"> <td >墙踵处压应力$\sigma\_{2k}$</td></tr>

                                    <tr id="result\_sigma\_pk"> <td >平均压应力$\sigma\_{pk}$</td></tr>

                                </tbody>

                            </table>

                        </fieldset>

                </div>

                <div class="span6">

                    <fieldset>

                        <legend>永久荷载+主可变荷载+地震荷载</legend>

                        <table align="left" cellpadding="1" cellspacing="1" style="width: 500px;">

                            <tbody id="check\_4">

                                <tr>

                                    <th>检测项目</th>

                                    <th>不安全荷载</th>

                                    <th>安全荷载</th>

                                    <th>检算结果</th>

                                </tr>

                                <tr id="result\_K\_c"> <td >滑动稳定性</td></tr>

                                <tr id="result\_K\_0"> <td >倾覆稳定性</td></tr>

                                <tr id="result\_e">   <td >偏心距e</td></tr>

                                <tr id="result\_sigma\_1k"> <td >墙趾处压应力$\sigma\_{1k}$</td></tr>

                                <tr id="result\_sigma\_2k"> <td >墙踵处压应力$\sigma\_{2k}$</td></tr>

                                <tr id="result\_sigma\_pk"> <td >平均压应力$\sigma\_{pk}$</td></tr>

                            </tbody>

                        </table>

                    </fieldset>

                </div>

            </div>

            <div class="row">

                <p></p>

                <p></p>

                <div class="span12">

                        <fieldset>

                            <legend>最终结果</legend>

                            <h4 class="result\_text" id="result\_con"></h4>

                        </fieldset>

                </div>

            </div>

        </div>

    </div>

<footer id="footer">

    <div class="container" data-index="179">

        <p>扶壁式挡土墙稳定性检算系统 ~ 2022</p>

    </div>

</footer>

</body>

<script>

    draw\_po("quad")

    for (let i of document.querySelector("#design\_table").querySelectorAll("input")) {

        i.addEventListener("change",function(){

            draw\_po("quad");

        })

    }

    $(document).ready(function () {

        $(".help").mouseover(function () {

            $("#chi").show();

        });

        $(".help").mouseout(function () {

            $("#chi").hide();

        });

        $("#help\_po").mouseover(function () {

            $("#img\_po").show();

        });

        $("#help\_po").mouseout(function () {

            $("#img\_po").hide();

        });

        $("#img\_po").mouseover(function () {

            $("#img\_po").show();

        });

        $("#img\_po").mouseout(function () {

            $("#img\_po").hide();

        });

    })

    a = [

    "8.5",

    "6",

    "0.4",

    "0.4",

    "0.5",

    "2",

    "",

    "on",

    "1.5",

    "",

    "0.4",

    "",

    "2.5",

    "",

    "1.5",

    "删除此行",

    "删除此行",

    "5",

    "0",

    "3.1",

    "3.2",

    "1",

    "0.5",

    "500",

    "25",

    "35",

    "19",

    "0.5",

    "0",

    "0.25",

    "1.1"

]

    $("input").each((i,e)=>{e.value = a[i]})

// $("input").each((i,e)=>{a.push(e.value)})

</script>

</html>

## 1.3 style.css

/\*

CSS Reset

http://meyerweb.com/eric/tools/css/reset/

\*/

html, body, div, span, applet, object, iframe,

h1, h2, h3, h4, h5, h6, p, blockquote, pre,

a, abbr, acronym, address, big, cite, code,

del, dfn, em, img, ins, kbd, q, s, samp,

small, strike, strong, sub, sup, tt, var,

b, u, i, center,

dl, dt, dd, ol, ul, li,

fieldset, form, label, legend,

table, caption, tbody, tfoot, thead, tr, th, td,

article, aside, canvas, details, embed,

figure, figcaption, footer, header, hgroup,

menu, nav, output, ruby, section, summary,

time, mark, audio, video {

margin: 0;

padding: 0;

border: 0;

font-size: 100%;

font: inherit;

vertical-align: baseline;

}

article, aside, details, figcaption, figure,

footer, header, hgroup, menu, nav, section {

display: block;

}

body {

line-height: 1;

}

ol, ul {

list-style: none;

}

blockquote, q {

quotes: none;

}

blockquote:before, blockquote:after,

q:before, q:after {

content: '';

content: none;

}

table {

border-collapse: collapse;

border-spacing: 0;

}

/\* particleground demo \*/

\* {

-webkit-box-sizing: border-box;

-moz-box-sizing: border-box;

box-sizing: border-box;

}

html, body {

width: 100%;

height: 100%;

overflow: hidden;

}

body {

background: #16a085;

font-family: 'Montserrat', sans-serif;

color: #fff;

line-height: 1.3;

-webkit-font-smoothing: antialiased;

}

#particles {

width: 100%;

height: 100%;

overflow: hidden;

}

#intro {

position: absolute;

left: 0;

top: 50%;

padding: 0 20px;

width: 100%;

text-align: center;

}

h1 {

text-transform: uppercase;

font-size: 85px;

font-weight: 700;

letter-spacing: 0.015em;

}

h1::after {

content: '';

width: 80px;

display: block;

background: #fff;

height: 10px;

margin: 30px auto;

line-height: 1.1;

}

p {

margin: 0 0 30px 0;

font-size: 24px;

}

.btn {

display: inline-block;

padding: 15px 30px;

border: 2px solid #fff;

text-transform: uppercase;

letter-spacing: 0.015em;

font-size: 18px;

font-weight: 700;

line-height: 1;

color: #fff;

text-decoration: none;

-webkit-transition: all 0.4s;

-moz-transition: all 0.4s;

-o-transition: all 0.4s;

transition: all 0.4s;

}

.btn:hover {

color: #005544;

border-color: #005544;

}

@media only screen and (max-width: 1000px) {

h1 {

font-size: 70px;

}

}

@media only screen and (max-width: 800px) {

h1 {

font-size: 48px;

}

h1::after {

height: 8px;

}

}

@media only screen and (max-width: 568px) {

#intro {

padding: 0 10px;

}

h1 {

font-size: 30px;

}

h1::after {

height: 6px;

}

p {

font-size: 18px;

}

.btn {

font-size: 16px;

}

}

@media only screen and (max-width: 320px) {

h1 {

font-size: 28px;

}

h1::after {

height: 4px;

}

}

## 1.4 input.js

var submit\_data = {

"design":{},

"tu":{},

"parms":{}

}

var scale = 30

var offset = [80,550]

var safe = `<svg t="1650422551299" class="icon" viewBox="0 0 1024 1024" version="1.1" xmlns="http://www.w3.org/2000/svg" p-id="2862" width="16" height="16"><path d="M68 528.4s229.6 188 252.4 347.6c0 0 301.2-492.8 635.6-536.8 0 0-102-74.4-68.4-191.6 0 0-185.6 18.4-535.2 561.2l-164-278.4L68 528.4z m0 0" fill="#22AC38" p-id="2863"></path></svg>`

var not\_safe = `<svg t="1650423738932" class="icon" viewBox="0 0 1025 1024" version="1.1" xmlns="http://www.w3.org/2000/svg" p-id="9073" width="16" height="16"><path d="M718.882684 511.351282 1010.410118 800.927611C1024.685139 815.107052 1027.762671 835.153596 1017.28356 845.70286L849.127929 1014.985224C838.649124 1025.534489 818.582055 1022.591441 804.307034 1008.412L512.781438 718.837509 223.267604 1010.296628C209.089387 1024.570118 189.044682 1027.647038 178.496643 1017.169458L9.230209 849.03282C-1.318137 838.554934 1.624604 818.49001 15.802821 804.216827L305.314511 512.759546 13.70467 223.101423C-0.570351 208.921981-3.647577 188.875438 6.831534 178.326173L174.986859 9.043809C185.46597-1.505455 205.533039 1.437592 219.80806 15.617034L511.415756 305.273319 801.039568 13.703302C815.217785-0.570187 835.26249-3.647107 845.810529 6.83078L1015.076963 174.967417C1025.625309 185.444997 1022.682568 205.509921 1008.504351 219.78341L718.882684 511.351282Z" p-id="9074" fill="#d81e06"></path></svg>`

var check\_flag = true

function change\_BT(){

if (document.querySelector("#have\_tenon").checked){

for(let i of ["#HT","#BT","#BT1"]){

document.querySelector(i).disabled = false

}

}else{

for(let i of ["#HT","#BT","#BT1"]){

document.querySelector(i).disabled = true

}

}

}

function check\_limit(e,min\_,max\_){

//检查输入是否超出限制

if (e.value > max\_ || e.value < min\_){

alert(`${e.parentElement.innerText} 超出规范限制(${min\_},${max\_})，请检查数据`)

}

}

//保留n位小数

function roundFun(value, n) {

return Math.round(value\*Math.pow(10,n))/Math.pow(10,n);

}

function get\_design\_data(){

let Decimal = 5 //小数点后几位

let design = {

//用户输入

"H" : 8.5, //挡土墙高度

"H2" : 0.5, //趾板高

"H3" : 0.5, //踵板高

"B" : 0.4, //立壁板顶宽

"B2" : 1.5, //趾板宽

"B3" : 2.5, //踵板宽

"Hzd" : 0.75, //趾端高度

"L" : 6,//每节扶壁墙长度

"B\_fb" : 0.5, //扶壁宽度

"num\_fb":2,//单节扶壁墙扶壁数量

"have\_tenon" : true, //是否设凸榫

"HT" : 0.5, //凸榫高度

"BT" : 0.5, //凸榫宽度

"BT1" : 2, //凸榫外缘距墙趾的距离

"cover\_h":1.5,//墙趾埋深

}

for(let i of ["H","H2","H3","B","B2","B3","Hzd","L","B\_fb","num\_fb","cover\_h"]){

let v = document.getElementById(i).value

if(v){

design[i] = roundFun(parseFloat(v),Decimal)

}

}

if(document.getElementById("have\_tenon").checked){

design["have\_tenon"] = true

for(let i of ["HT","BT","BT1"]){

let v = document.getElementById(i).value

if(v){

design[i] = roundFun( parseFloat(v),Decimal)

}

}

}else{

design["have\_tenon"] = false

design["HT"] = 0

design["BT"] = 0

design["BT1"] = 0

}

//以墙趾处为原点

let H = design["H"]

let H2 = design["H2"]

let H3 = design["H3"]

let B = design["B"]

let B2 = design["B2"]

let B3 = design["B3"]

let Hzd = design["Hzd"]

let HT = design["HT"]

let BT = design["BT"]

let BT1 = design["BT1"]

let coords = [[0,0],[0,H2],[B2,Hzd],[B2,H],[B2+B,H],[B2+B,H3],[B2+B+B3,H3],[B2+B+B3,0]]

if(design["have\_tenon"]){

coords.push([BT1+BT,0],[BT1+BT,-HT],[BT1,-HT],[BT1,0],[0,0])

}else{

coords.push([0,0])

}

for(i of coords){

i[0] = roundFun(i[0],Decimal)

i[1] = roundFun(i[1],Decimal)

}

design["coords"] = coords

design["coord\_qz"] = [ roundFun(B+B2+B3,Decimal),0]

design["coord\_qd"] = [ roundFun(B2+B,Decimal),H]

submit\_data["design"] = design

}

function clearCanvas(canvas\_id)

{

var c=document.getElementById(canvas\_id);

c.height=c.height;

}

function polygon(canvas\_id,coords) {

//绘制多边形

var canvas = document.getElementById(canvas\_id);

var context = canvas.getContext("2d");

context.strokeStyle = "#008";

context.lineWidth = 2; // 2个像素宽

context.beginPath();

context.moveTo(offset[0]+coords[0][0]\*scale,offset[1] -coords[0][1]\*scale);

for (let i=1; i<coords.length; i++) {

context.lineTo(offset[0]+coords[i][0]\*scale,offset[1]-coords[i][1]\*scale);

}

context.stroke();

context.closePath();

}

function draw\_wall(canvas\_id){

// 获得 canvas.context

clearCanvas(canvas\_id)

get\_design\_data()

polygon(canvas\_id,submit\_data["design"]["coords"],);

}

function add\_tu(){

//展示数据

let html = `<tr>

<td>${document.querySelector("#po\_h").value}</td>

<td>${document.querySelector("#po\_v").value}</td>

<td>${document.querySelector("#tu\_h").value}</td>

<td>${document.querySelector("#tu\_w").value}</td>

<td>${document.querySelector("#tu\_j").value}</td>

<td><input type="button" class="btn btn-danger" value="删除此行" onclick="delate(this); draw\_po()"></td>

</tr>`

document.querySelector("#show\_po").innerHTML += html

document.querySelector("#show\_po\_div").style.display = "block"

}

function delate(e){

e.parentElement.parentElement.innerHTML=""

}

function get\_y(x0,y0,x1,y1,x){

//计算y值

let k = (y1-y0)/(x1-x0)

let y = k\*(x-x0)+y0

return y

}

function get\_tu\_data(){

let tu = [submit\_data["design"]["coord\_qd"]]

let tuzhu = []

let trs = document.querySelectorAll("#show\_po > tr")

for(let i=0;i<trs.length;i++){

let tds = trs[i].querySelectorAll("td")

if((! tds) ||(!tds[0]) ){

continue

}

if (tds[0].innerText && tds[1].innerText ){

let x = parseFloat(tds[0].innerText)+tu[tu.length-1][0]

let y = parseFloat(tds[1].innerText)+tu[tu.length-1][1]

tu.push([x,y])

}

if(tds[0].innerText && tds[1].innerText &&tds[2].innerText && tds[3].innerText && tds[4].innerText){

let height = parseFloat(tds[2].innerText)

let width = parseFloat(tds[3].innerText)

let j = parseFloat(tds[4].innerText)

let x = j + tu[tu.length-2][0]

let y = get\_y(tu[tu.length-2][0],tu[tu.length-2][1],tu[tu.length-1][0],tu[tu.length-1][1],x)

let x1 = x + width

let y1 = get\_y(tu[tu.length-2][0],tu[tu.length-2][1],tu[tu.length-1][0],tu[tu.length-1][1],x1)

tuzhu.push({

"start":[x,y],

"end":[x1,y1],

"height":height,

"width":width,

"coords":[[x,y],[x,y+height],[x1,y1+height],[x1,y1],[x,y]]

})

}

}

submit\_data["tu"] = {

"po":tu,

"tuzhu":tuzhu

}

return submit\_data["tu"]

}

function draw\_po(canvas\_id){

draw\_wall(canvas\_id)

let tu = get\_tu\_data()

if(tu["po"].length>1){

polygon(canvas\_id,tu["po"])

}

if(tu["tuzhu"].length>0){

for(let i=0;i<tu["tuzhu"].length;i++){

let tuzhu = tu["tuzhu"][i]

let x = tuzhu["start"][0]

let y = tuzhu["start"][1]

let x1 = tuzhu["end"][0]

let y1 = tuzhu["end"][1]

let height = tuzhu["height"]

polygon(canvas\_id,[[x,y],[x,y+height],[x1,y1+height],[x1,y1],[x,y]])

}

}

// console.log(submit\_data)

}

function get\_parms(){

let parms = {}

for(i of ["accuracy","f","gamma\_wall","base\_type","base\_sigma","phi","gamma\_soil","C\_z","k\_H","gamma\_0"]){

if(document.getElementById(i)&& document.getElementById(i).value){

if(i=="base\_type"){

parms[i] = document.getElementById(i).value

}else{

parms[i] = parseFloat(document.getElementById(i).value)

}

}else{

console.log("未输入",i)

alert("请输入 "+document.getElementById(i).parentElement.innerText)

return false

}

}

submit\_data["parms"] = parms

return parms

}

function write\_check(check,data){

for(i of ["K\_c","K\_0","e","sigma\_1k","sigma\_2k","sigma\_pk"]){

let load =/sigma/.test(i)? data[check]["sigma"][i] : data[check][i]

let ok\_str = `<span><i>${safe}</i> 通过</span>`

if(load[1] < load[0]){

ok\_str = `<span> <i>${not\_safe}</i>不通过</span>`

check\_flag = false

}

$("#"+check).find("#result\_"+i).append( `

<td class="result\_table" >${load[0]}</td>

<td class="result\_table" >${load[1]}</td>

<td class="result\_table" >${ok\_str}</td>`)

}

}

function submit\_data\_to\_server(){

//用ajax将submit上传到服务器

get\_design\_data()

get\_tu\_data()

let parms = get\_parms()

if(!parms){

return

}

if(submit\_data["tu"]["po"].length<2){

alert("请输入坡面数据")

return

}

$("#mask").show()

// console.log("submit\_data",JSON.stringify(submit\_data))

$.ajax({

url: "/submit",

type: "POST",

data: JSON.stringify(submit\_data),

contentType: "application/json; charset=utf-8",

dataType: "json",

success: function(data){

$("#mask").hide()

window.data = data

if(data["code"]!=0){

alert(data["msg"])

return

}

$(".result\_text").empty()

$(".result\_table").remove()

$("#result\_show").show()

data = data["data"]

polygon("quad",[submit\_data["design"]["coord\_qz"],data["jx\_start"]]);

polygon("quad",[submit\_data["design"]["coord\_qz"],data["jx\_end"]]); polygon("quad",[submit\_data["design"]["coord\_qz"],submit\_data["design"]["coord\_qd"]]);

$("#stress\_chart").attr("href",'.'+data["png\_stress"]);

fig = JSON.parse(data["png\_E\_3d"])

Plotly.newPlot("result3d", fig)

for(i of ["theta","alpha","B","area\_G","area\_W","area\_W1","sum\_M\_y","sum\_M\_0","sum\_M\_0","sum\_N"]){

$("#result\_"+i).html(`${data[i]}`)

}

if(!data["have\_2\_plm"]) {

$("#result\_have\_2\_plm").html(`假想墙背夹角：`)

$("#result\_area\_W\_desc").html(`真实墙背与假想墙背土体截面积：`)

$("#result\_area\_W1\_desc").html(`第一破裂面与假想墙背土体截面积：`)

}else{

$("#result\_have\_2\_plm").html(`第二破裂面夹角：`)

$("#result\_area\_W\_desc").html(`真实墙背与第二破裂面土体截面积：`)

$("#result\_area\_W1\_desc").html(`第一破裂面与第二破裂面土体截面积：`)

}

for (i of ["E\_a","G","W\_toe","W","W1","G\_p","W\_p","W1\_p"]){

$("#result\_"+i).append( `<td class="result\_table" >${data[i].num}</td>

<td class="result\_table" >${data[i].x}</td>

<td class="result\_table" >${data[i].y}</td>

<td class="result\_table" >${(String(data[i].pos))}</td>`)

}

check\_flag = true

for(i of ["check\_1","check\_4"]) write\_check(i,data)

if (check\_flag){

$("#result\_con").html("<span class='success'>经过计算，该挡墙符合相关设计规范要求，稳定性验算通过</span>")

}else{

$("#result\_con").html("<span class = 'danger'>经过计算，该挡墙不符合相关设计规范要求，稳定性验算不通过</span>")

}

MathJax.Hub.Queue(["Typeset",MathJax.Hub]);

$("html,body").animate({scrollTop: $("#result\_show").offset().top},300);

},

error: function(data){

$("#mask").hide()

console.log(data)

alert("程序错误！！")

}

});

}

# 服务器后端代码

## 2.1 server.py

from starlette.responses import RedirectResponse

from fastapi import Body, FastAPI

from fastapi.staticfiles import StaticFiles

from handle import \*

app = FastAPI()

app.mount("/static", StaticFiles(directory="./html"), name="static")

@app.get("/index.html")

async def redirect\_typer():

return RedirectResponse("/static/index.html")

@app.get("/")

async def redirect\_typer():

return RedirectResponse("/static/index.html")

@app.post('/submit')

def index(data=Body(...)):

try:

tmp = Dangtuqiang(data)

return\_data = tmp.get\_result()

return {

"code":0,

"data":return\_data,

"msg":"success"

}

except Exception as e:

return{

"code":1,

"msg":"程序错误！\n"+str(e)

}

## 2.2 stand.py

stand = {

"K\_c": {

"I":{ # 组合I 无水位 永久+主可变

"gamma\_E1":1.25,

"gamma\_G":0.75,

"gamma\_E2":0.85

},

"IV":{ # 组合IV I+地震

"gamma\_E1":1.3,

"gamma\_E2":0.9,

"gamma\_G":0.85

}

},

"K\_0":{

"I":{ # 组合I 无水位 永久+主可变

"gamma\_E1":1.5,

"gamma\_G":1,

"gamma\_E2":0.85

},

"IV":{ # 组合IV I+地震

"gamma\_E1":1.35,

"gamma\_E2":1,

"gamma\_G":0.9

}

},

"e":{

"a":{

"normal":0.25,

"earthquake":0.3333333

},

"b":{

"normal":0.16666666,

"earthquake":0.25

},

"c":{

"normal":0.16666666,

"earthquake":0.2

},

"d":{

"normal":0.16666666,

"earthquake":0.16666666

}

},

"sigma":{

"I":{ # 组合I 永久+主可变

"gamma\_toe":1, #墙趾处地基承载力

"gamma\_heel":1.3, #墙踵处地基承载力

"gamma\_a":1 #地基平均承载力

},

"IV":{ # 组合IV I+地震

"a":{

"gamma\_toe":1.5, #墙趾处地基承载力

"gamma\_heel":1.95, #墙踵处地基承载力

"gamma\_a":1.5 #地基平均承载力

},

"b":{

"gamma\_toe":1.4, #墙趾处地基承载力

"gamma\_heel":1.82, #墙踵处地基承载力

"gamma\_a":1.4 #地基平均承载力

},

"c":{

"gamma\_toe":1.3, #墙趾处地基承载力

"gamma\_heel":1.69, #墙踵处地基承载力

"gamma\_a":1.3 #地基平均承载力

},

"d":{

"gamma\_toe":1.2, #墙趾处地基承载力

"gamma\_heel":1.56, #墙踵处地基承载力

"gamma\_a":1.2 #地基平均承载力

}

}

}

}

## 2.3 handle.py

import os

from shapely.geometry import Polygon, LineString, Point, box

import math

import numpy as np

from stand import \*

import plotly.graph\_objs as go

import plotly

from matplotlib import pyplot as plt

import uuid

class Force():

def \_\_init\_\_(self,num,degree,pos,moment=0):

# num: 力的大小，degree: 力的方向（x轴夹角），pos: 力的位置Point类,moment: 弯矩

self.num = num

self.degree = degree

self.pos = pos

self.moment = moment

self.y = self.num \* math.sin(math.radians(self.degree))

self.x = self.num \* math.cos(math.radians(self.degree))

self.vector = np.array([self.x,self.y]) # 力的向量

def join(self,force):

# 返回与其他力的结合力

# force: 其他力，Force类

# 返回值：结合力，Force类

new\_vector = self.vector + force.vector

new\_num = math.sqrt(np.sum(new\_vector\*\*2))

moment = self.moment + force.moment #两个 力原有的弯矩之和

moment += (force.pos.x - self.pos.x) \* force.y # y方向分力导致的弯矩

moment += (force.pos.y - self.pos.y) \* force.x # x方向分力导致的弯矩

degree = math.degrees(math.atan(new\_vector[1]/new\_vector[0]))

return Force(new\_num,degree,self.pos,moment=moment)

def move\_to(self,point):

# 将力移动到某点 力的大小方向不变，弯矩、位置变化

# point: 点，Point类

# 返回值：力，Force类

moment = self.moment + (self.pos.x - point.x) \* self.y + (self.pos.y - point.y) \* self.x

return Force(self.num,self.degree,point,moment=moment)

def print\_data(self,desc = ''):

if desc:

print('\n',desc)

print("""力的大小：{self.num}\n分力:[{self.x},{self.y}]\n力的方向(与x轴夹角)：{self.degree}\n力的位置：{self.pos.x},{self.pos.y}\n弯矩：{self.moment}""".format(self=self))

def get\_info(self):

desc = 3

return {

'num':round(self.num,desc),

"x":round(self.x,desc),

"y":round(self.y,desc),

# 'degree':self.degree,

'pos':[round(self.pos.x,desc),round(self.pos.y,desc)]

}

# #Force 类测试

# a = Force(2,45,Point(0,0),3)

# b = Force(3,-90,Point(1,0))

# c = a.join(b)

# c.print\_data()

# d = Force(1,-90,Point(1,0))

# d.move\_to(Point(2,1)).print\_data()

class Dangtuqiang():

def \_\_init\_\_(self, data):

# read data

self.design = data["design"]

self.tu = data["tu"]

self.parms = data["parms"]

self.phi = data["parms"]["phi"]

self.accuracy = data["parms"]["accuracy"]

self.fake\_wall\_line = LineString(

[data["design"]["coord\_qz"], data["design"]["coord\_qd"]]) # 假想墙背线

self.po\_xian = LineString(data["tu"]["po"])

self.qz = data["design"]["coord\_qz"]

self.qd = data["design"]["coord\_qd"]

self.gamma\_wall = data["parms"]["gamma\_wall"]

self.gamma\_soil = data["parms"]["gamma\_soil"]

#.eta = math.degrees(math.atan(self.parms["C\_z"]\*self.parms["k\_H"])) # 地震角

self.C\_z = data["parms"]["C\_z"]

self.k\_H = data["parms"]["k\_H"]

self.base\_type = data["parms"]["base\_type"]

self.gamma\_0 = data["parms"]["gamma\_0"]

self.i = 0

# init

self.alpha, self.theta = 0, 0

self.dec = 3 # 保留小数点后几位

self.rho = round(math.degrees(

math.atan(data["design"]["B3"]/data["design"]["H"])),self.dec)

def sin(self, degree):

# 接受degree，转化为弧度计算sin

return math.sin(math.radians(degree))

def cos(self, degree):

return math.cos(math.radians(degree))

def tan(self, degree):

return math.tan(math.radians(degree))

def show(self, coords):

# 根据 coords 显示图形

x, y = [], []

for i in coords:

x.append(i[0])

y.append(i[1])

plt.plot(x, y)

def show\_po(self):

# 调试 显示 原点到交线楔形体的面积

self.show(self.tu["po"])

for i in self.tu["tuzhu"]:

self.show(i["coords"])

# print("交点",jd1,jd2,list(jx.coords))

# print("墙踵",qz)

#self.show([self.qz]+list(self.jx.coords)+[self.qz])

self.show(self.design["coords"])

def show\_shape(self,shape):

# 传入shapely对象

self.show(shape.exterior.coords)

def cal\_stress(self,coords):

# 计算应力,输入土体高度，输出应力，《铁道工程》p291

return [[self.lambda\_a \* self.gamma\_soil \* i[0],i[1]] for i in coords]

def to\_round(self,list\_or\_num):

# 将数字或者数组转化为保留小数点后几位的数字

if isinstance(list\_or\_num,list):

return [round(i,self.dec) for i in list\_or\_num]

else:

return round(list\_or\_num,self.dec)

def cal\_jx(self,qz,alpha,theta):

#返回破裂面之间的交线

x1 = qz[0] - (100-qz[1]) \* self.tan(alpha) #无限远处（100远）的第二破裂面x坐标

x2 = qz[0] + (100-qz[1]) \* self.tan(theta) #无限远处（100m远）的第1破裂面x坐标

jx = Polygon([qz, [x1, 100], [x2, 100]]).intersection(self.po\_xian) # 中间交线，可能为空

return jx

def get\_centroid(self,polygons):

# 获取多个多边形的质心

# 输入多边形列表

x = 0

y = 0

total\_area = 0

for i in polygons:

area = i.area

total\_area += area

x += i.centroid.x\*area

y += i.centroid.y\*area

return Point(x/total\_area,y/total\_area)

def cal\_area(self, alpha, theta):

# 给定alpha,theta，计算楔形体的面积

# 过qz和qd点的直线与坡线的交点

qz = self.qz #墙踵坐标，作为原点

jx = self.cal\_jx(qz,alpha,theta) #交线

# # 调试 显示 原点到交线楔形体的面积

# self.show(self.tu["po"])

# for i in self.tu["tuzhu"]:

# self.show(i["coords"])

# # print("交点",jd1,jd2,list(jx.coords))

# # print("墙踵",qz)

# self.show([qz]+list(jx.coords)+[qz])

# self.show\_po()

# plt.savefig(f"./{self.i}.png")

# self.i += 1

# #plt.show()

# plt.close()

#计算填土部分的多边形面积 qz->交线->qz

xxt = Polygon([qz]+list(jx.coords)+[qz])

# 计算土柱中属于第一二破裂面的部分的面积及属于稳定自重的部分

before\_tuzhu = [] # 土柱中属于自重的部分，保存成一个多边形，方便计算重心

for i in self.tu["tuzhu"]:

# 遍历每个土柱，判断土柱是否在交线上

dx\_tuzhu = LineString([i["start"],i["end"]]) #土柱底部线段

jx\_tuzhu = dx\_tuzhu.intersection(jx) #土柱底部线段与交线相交部分

if jx\_tuzhu.is\_empty:

#未相交，可能在左右两侧

if i["end"][0]<= list(jx.coords)[0][0]:

#土柱在左侧

before\_tuzhu += [Polygon(i["coords"])]

else:

#右侧不管

pass

else:

#相交

jx\_tuzhu\_start =list(jx\_tuzhu.coords)[0]

jx\_tuzhu\_end =list(jx\_tuzhu.coords)[-1]

xxt = xxt.union(Polygon([jx\_tuzhu\_start,jx\_tuzhu\_end,[jx\_tuzhu\_end[0],jx\_tuzhu\_end[1]+i["height"]],[jx\_tuzhu\_start[0],jx\_tuzhu\_start[1]+i["height"]],jx\_tuzhu\_start]))

if i["start"][0] < jx\_tuzhu\_start[0]:

#土柱有一部分在左侧

before\_tuzhu += [Polygon([i["start"],jx\_tuzhu\_start,[jx\_tuzhu\_start[0],jx\_tuzhu\_start[1]+i["height"]],[i["start"][0],i["start"][1]+i["height"]],i["start"]])]

#before\_tuzhu\_area,#土柱中属于自重的面积

# 楔形体全部面积为楔形体面积加土柱中属于楔形体的面积

result = (before\_tuzhu,xxt)

return result

def cal\_force\_pos(self,alpha,theta):

# 输入alpha，theta，汇出土压力图形，计算作用点位置

coords = [[0,0]]

self.lambda\_a = (self.tan(self.theta)-self.tan(self.alpha))\*self.cos(self.theta+self.phi)/self.sin(self.theta+2\*self.phi+self.alpha)

# 计算楔形体中的土压力应力

self.jx = self.cal\_jx(self.qz,alpha,theta)

jx\_start = list(list(self.jx.coords)[0])

jx\_end = list(list(self.jx.coords)[-1])

self.jx\_start = jx\_start

self.jx\_end = jx\_end

self.second\_plm\_line = LineString([self.qz,jx\_start])

self.first\_plm\_line = LineString([self.qz,jx\_end])

x1 =jx\_start[0] + (100-jx\_start[1])\*self.tan(theta)

pol = Polygon([self.qz,jx\_start,[x1,100],jx\_end,self.qz])

tmp\_jx = pol.intersection(self.po\_xian)

coords.append([0,jx\_start[1]])

for point in list(tmp\_jx.coords)[1:-1]:

#过point做夹角为(90-theta)的直线，交fake\_wall\_line于jd

x1 = point[0] - point[1]\*self.tan(theta)

jd = LineString([[x1,0],point]).intersection(self.second\_plm\_line)

# print("绘制交点",point,jd)

# self.show([[x1,0],point])

coords.append([point[1]-jd.y,jd.y])

coords += [[jx\_end[1],0],[0,0]]

coords = self.cal\_stress(coords)

pol1 = Polygon(coords) #由填土构成的土压力应力图

for i in self.tu["tuzhu"]:

start,end,height = i["start"],i["end"],i["height"]

if start[0]<jx\_start[0]<end[0]:

#土柱在左侧中间

start = jx\_start

elif start[0]<jx\_end[0]<end[0]:

#土柱在右侧中间

end = jx\_end

elif jx\_start[0] <= start[0] and end[0] <= jx\_end[0]:

#土柱在楔形体内部

pass

else:

#土柱在楔形体外部

continue

#计算土柱中构成的土压力应力图

jd1 = LineString([start,[start[0]-start[1]\*self.tan(theta),0]]).intersection(self.second\_plm\_line)

jd2 = LineString([end,[end[0]-end[1]\*self.tan(theta),0]]).intersection(self.second\_plm\_line)

coords2 = [[0,jd1.y],[start[1]-jd1.y+height,jd1.y],[end[1]-jd2.y+height,jd2.y],[0,jd2.y]]

coords2 = self.cal\_stress(coords2)

pol1 = pol1.union(Polygon(coords2))

# 混凝土夹角

# H3 = self.design["H3"]

# jd3 = LineString([[self.qz[0]-H3\*self.tan(theta),0],[self.qz[0],H3]]).intersection(self.second\_plm\_line)

# pol3 = Polygon([[0,0],[0,H3],[(H3-jd3.y)\*self.gamma\_wall/self.gamma\_soil,jd3.y],[0,0]])

#centroid = self.get\_centroid([pol1,pol3]) #3.1942848678412874 差别不大

centroid = pol1.centroid

# # 应力图展示

plt.axis("off")

plt.rcParams['font.family'] = 'SimHei'

plt.cla()

plt.subplot(221)

plt.title('挡土墙截面图')

ax1 = plt.gca()

ax1.set\_ylim([0,20])

ax1.set\_xlim([0,20])

self.show\_po()

plt.subplot(222)

plt.title('土压力分布及重心位置')

ax1 = plt.gca()

ax1.set\_ylim([0,20])

ax1.set\_xlim([0,50])

self.show(list(pol1.exterior.coords))

plt.scatter(centroid.x,centroid.y)

plt.text(centroid.x+1,centroid.y-1,'重心')

plt.margins(0, 0)

# plt.show()

self.stress\_path =f"/tmp/{uuid.uuid4().hex}.png"

plt.savefig("./html"+self.stress\_path,dpi=200,bbox\_inches='tight')

plt.close()

#计算土压力作用点` `

return Point(self.qz[0]-self.tan(alpha)\*centroid.y,centroid.y)

def cal\_E\_a(self):

# 土压力、楔体重力

tmps = []

Z = []

theta\_range = np.arange(0, 90-self.phi, self.accuracy)

if theta\_range[-1] != 90-self.phi:

theta\_range = np.append(theta\_range, 90-self.phi)

alpha\_range = np.arange(self.accuracy, self.rho, self.accuracy) #跳过0

if alpha\_range[-1] != self.rho:

alpha\_range = np.append(alpha\_range, self.rho)

theta\_range = list(theta\_range)

alpha\_range = list(alpha\_range)

##############################

# alpha\_range = [15.331]

# theta\_range = [25.812]

##############################

for theta in theta\_range:

z\_s = []

for alpha in alpha\_range:

alpha = round(alpha, self.dec)

# print(theta, alpha)

# 计算楔形体的重力

self.before\_tuzhu,xxt = self.cal\_area(alpha, theta) #土柱中属于自重的面积，楔形体的面积

W1 = Force(xxt.area\* self.gamma\_soil,-90,xxt.centroid)

# 计算土压力

E = self.sin(90-theta-self.phi)/self.sin(alpha+theta+2\*self.phi)\*W1.num

Ex = E\*self.sin(90-alpha-self.phi)

Ey = E\*self.cos(90-alpha-self.phi)

tmps.append((theta,alpha,Ex,Ey,E,W1,xxt.area))

z\_s.append(Ex)

Z.append(z\_s)

tmp\_max = max(tmps, key=lambda x: x[2])

self.theta,self.alpha,self.E\_x,self.E\_y,self.E,self.W1,self.area\_W1 = tmp\_max

self.alpha,self.theta = float(self.alpha),float(self.theta)

self.have\_2\_plm = 0 if self.alpha == self.rho else 1 #是否有第二破裂面

# 此时已经求出了土压力大小，方向已知

# print('max', tmp\_max)

# # 2d 图

# c = [[x[1], x[0]\*self.sin(90-x[2]-self.phi)] for x in tmps]

# self.show(c)

# plt.show()

#3d图

# fig = plt.figure() # 定义新的三维坐标轴

# # ax3 = plt.axes(projection='3d')

# # # 作图

# # ax3.plot\_surface(X, Y, Z, cmap='rainbow')

# # self.png\_E\_3d = self.get\_png(plt)

# # # plt.show()

# # plt.close()

# # 定义三维数据

X, Y = np.meshgrid(alpha\_range, theta\_range)

Z = np.array(Z)

data=[go.Surface(x=X, y=Y, z=Z)]

fig = go.Figure(data)

fig.update\_layout(

title\_text='土压力随破裂角变化图',

autosize=True,

scene=dict(

xaxis=dict(title = "第二破裂角"),

yaxis=dict(title = '第一破裂角'),

zaxis=dict(title = '主动土压力水平分力'),

annotations=[

dict(

x= self.alpha,

y= self.theta,

z=self.E\_x,

text="主动土压力Ea",

textangle=0,

ax=0,

ay=-75,

font=dict(

color="black",

size=12

)

)]

),

)

self.png\_E\_3d = plotly.io.to\_json(fig)

# 求作用点,画应力图

pos = self.cal\_force\_pos(self.alpha,self.theta)

# 土压力解算完毕，大小为self.E,方向为 self.alpha+self.fhi,作用点为pos

return Force(self.E,self.alpha+self.phi,pos)

def cal\_W(self):

# 计算挡墙自重，包括混凝土墙身、第二破裂面与真实墙背间的土重、属于自重的土柱

# 1.混凝土墙身,T形截面重力W1\_t,扶壁重力算入土重

pol1 = Polygon(self.design["coords"])

# 2.第二破裂面与真实墙背间的土重

H3 = self.design["H3"]

x1 = self.qz[0]-self.tan(self.alpha)\*H3 #第二破裂面与墙踵上边缘的交点

left\_po\_xian = box(0,0,self.jx\_start[0],self.jx\_start[1]+100).intersection(self.po\_xian)

pol2 = Polygon([[x1,H3],[self.qz[0]-self.design["B3"],H3]]+list(left\_po\_xian.coords)+[[x1,H3]])

# 3.属于自重的土柱

pol3 = self.before\_tuzhu

#绘图 重力部分图形

# self.show\_shape(W2)

# self.show\_shape(W1)

# for i in W3:

# self.show\_shape(i)

# plt.show()

#总的重力 W,与理正误差为千分之1，忽略不计

for i in pol3:

pol2 = pol2.union(i)

self.G = Force(pol1.area\*self.gamma\_wall,-90,pol1.centroid)

self.W = Force(pol2.area\*self.gamma\_soil,-90,pol2.centroid)

self.area\_G = pol1.area

self.area\_W = pol2.area

return self.G,self.W #G为挡墙自重，W实际墙背与第二破裂面之间的土重 W1为破裂体的重力

def cal\_exforce(self):

# 计算外力

# 1.土压力

self.E\_a = self.cal\_E\_a()

# self.E\_a.print\_data("E\_a")

# 2.自重

self.G,self.W = self.cal\_W() #G为挡墙自重，W实际墙背与第二破裂面之间的土重

#墙趾板土重力

W\_toe = Polygon([[0,self.design["H2"]],[self.design["B2"],self.design["Hzd"]],[self.design["B2"],self.design["cover\_h"]],[0,self.design["cover\_h"]],[0,self.design["H2"]]])

self.W\_toe = Force(W\_toe.area\*self.gamma\_soil,-90,W\_toe.centroid)

# 3.地震时土压力

# 第一二破裂面之间的楔形体的地震力

self.W1\_p = Force(self.W1.num \* self.C\_z \*self.k\_H,180,self.W1.pos)

# 第二破裂面与真实墙背间的地震力

self.W\_p = Force(self.W.num \* self.C\_z \*self.k\_H,180,self.W.pos)

# 挡墙自身受到的地震力

self.G\_p = Force(self.G.num \* self.C\_z \*self.k\_H,180,self.G.pos)

def check\_k\_c(self,data,gamma\_E1,gamma\_G,gamma\_E2):

#滑动稳定性检测 《极限状态法》p91

W,E\_y,E\_x,F\_hE,f\_p,Z\_x,Z\_y,Z\_hE,Z\_W = data

S\_ddst = gamma\_E1 \* E\_x + F\_hE #不平衡作用效应设计值

S\_dstb = (gamma\_G \* W +gamma\_E2 \*E\_y)\*f\_p #平衡作用设计值

return self.to\_round([S\_ddst\*self.gamma\_0,S\_dstb])

def check\_k\_0(self,data,gamma\_E1,gamma\_G,gamma\_E2):

#倾覆稳定性检测 《极限状态法》p93

W,E\_y,E\_x,F\_hE,f\_p,Z\_x,Z\_y,Z\_hE,Z\_W = data

S\_ddst = gamma\_E1 \* E\_x \* Z\_x + F\_hE \* Z\_hE #不平衡作用效应设计值

S\_dstb = gamma\_G \* W \* Z\_W + gamma\_E2 \* E\_y \* Z\_y #平衡作用设计值

return self.to\_round([S\_ddst\*self.gamma\_0,S\_dstb])

def check\_e(self,data,limit):

W,E\_y,E\_x,F\_hE,f\_p,Z\_x,Z\_y,Z\_hE,Z\_W = data

self.B = self.qz[0] #基底宽度

#稳定力系

self.sum\_M\_y = self.W\_toe.num \* self.W\_toe.pos.x + \

self.G.num \* self.G.pos.x + \

self.W.num \* self.W.pos.x + \

abs(self.E\_a.y) \* self.E\_a.pos.x

#倾覆力系力矩

self.sum\_M\_0 = abs(self.E\_a.x) \* self.E\_a.pos.y + \

self.G\_p.num \* self.G\_p.pos.y + \

self.W\_p.num \* self.W\_p.pos.y + \

self.W1\_p.num \* self.E\_a.pos.y #此处为简化

self.sum\_N = W + abs(self.E\_a.y) + self.W.num +self.W\_toe.num #作用在基底上的竖直力 ：挡墙自重，主动土压力竖向分力，实际墙背与第二破裂面之间的土重

self.c = (self.sum\_M\_y - self.sum\_M\_0)/self.sum\_N

self.e = self.B/2 - self.c

limit = self.B \* limit #偏心距限定值 ，《极限状态法》p95

return self.to\_round([self.e,limit])

def check\_sigma(self,sigma,gamma\_toe,gamma\_heel,gamma\_a):

#基底应力检测

# sigma 地基承载力特征值

if abs(self.e) <= self.B/6:

sigma\_1k = self.sum\_N/self.B\*(1+6\*self.e/self.B)

sigma\_2k = self.sum\_N/self.B\*(1-6\*self.e/self.B)

elif self.e > self.B/6:

sigma\_1k = 2\*self.sum\_N/3/self.c

sigma\_2k = 0

else:

sigma\_1k = 0

sigma\_2k = 2\*self.sum\_N/3/(self.B - self.c)

sigma\_pk = (sigma\_1k + sigma\_2k)/2

return {

"sigma\_1k":self.to\_round([sigma\_1k,gamma\_toe \* sigma]),

"sigma\_2k":self.to\_round([sigma\_2k,gamma\_heel \* sigma]),

"sigma\_pk":self.to\_round([sigma\_pk,gamma\_a \* sigma])

}

def check(self,type = 'I'):

# 检测稳定性

# 输入type为组合类型，I为永久+主可变，IV 为永久+主可变+地震

W = self.G.num

E\_y = self.E\_a.y + self.W.num + self.W\_toe.num

E\_x = self.E\_a.x

F\_hE = self.G\_p.num #无地震时G是0

if type == "IV":

#验算地震时

E\_x = self.E\_a.x + self.W\_p.num + self.W1\_p.num

f\_p = 1.5 \*self.parms["f"]

Z\_x = self.E\_a.pos.y

Z\_y = self.E\_a.pos.x

Z\_hE = self.G\_p.pos.y

Z\_W = self.G.pos.x

data = (W,E\_y,E\_x,F\_hE,f\_p,Z\_x,Z\_y,Z\_hE,Z\_W)

# 1. k\_c检测,滑动稳定性检测

gamma\_E1,gamma\_G,gamma\_E2 = stand["K\_c"][type]["gamma\_E1"],stand["K\_c"][type]["gamma\_G"],stand["K\_c"][type]["gamma\_E2"]

result\_k\_c = self.check\_k\_c(data,gamma\_E1,gamma\_G,gamma\_E2)

# 2. K\_0检测,倾覆稳定性检测

gamma\_E1,gamma\_G,gamma\_E2 = stand["K\_0"][type]["gamma\_E1"],stand["K\_0"][type]["gamma\_G"],stand["K\_0"][type]["gamma\_E2"]

result\_k\_0 = self.check\_k\_0(data,gamma\_E1,gamma\_G,gamma\_E2)

# 3. 计算偏心距并检测 e

e\_type = "normal" if type == "I" else "earthquake"

e\_limit = stand["e"][self.base\_type][e\_type]

result\_e = self.check\_e(data,e\_limit)

# # 4. sigma检测，基地应力检测

if type == "I":

gamma\_toe,gamma\_heel,gamma\_a = stand["sigma"][type]["gamma\_toe"],stand["sigma"][type]["gamma\_heel"],stand["sigma"][type]["gamma\_a"]

else:

gamma\_toe,gamma\_heel,gamma\_a = stand["sigma"][type][self.base\_type]["gamma\_toe"],stand["sigma"][type][self.base\_type]["gamma\_heel"],stand["sigma"][type][self.base\_type]["gamma\_a"]

result\_sigma = self.check\_sigma(self.parms["base\_sigma"],gamma\_toe,gamma\_heel,gamma\_a)

return {

"K\_c":result\_k\_c,

"K\_0":result\_k\_0,

"e":result\_e,

"sigma":result\_sigma

}

def get\_result(self,img=True):

# 获取检测结果

self.cal\_exforce()

#组合I 计算 永久荷载+主可变荷载

result\_check\_1 = self.check('I')

#组合IV 计算 永久荷载+主可变荷载 + 地整荷载

result\_check\_4 = self.check('IV')

return {

"png\_E\_3d":self.png\_E\_3d if img else "",

"png\_stress":self.stress\_path,

"B":self.B, #基底宽度

"theta":self.theta, #第一破裂角度

"alpha":self.alpha, #第二破裂角度

"jx\_start":self.to\_round(self.jx\_start),#第二破裂面

"jx\_end":self.to\_round(self.jx\_end),#第一破裂面

"have\_2\_plm": self.have\_2\_plm,#是否有第二破裂面

"area\_G":self.to\_round(self.area\_G),#挡墙截面积

"area\_W":self.to\_round(self.area\_W),#真实墙背与第二破裂面间土体截面积

"area\_W1":self.to\_round(self.area\_W1), #第一破裂面与第二破裂面间土体截面积

"sum\_M\_y":self.to\_round(self.sum\_M\_y),#总稳定弯矩

"sum\_M\_0":self.to\_round(self.sum\_M\_0),#总倾覆弯矩

"sum\_N":self.to\_round(self.sum\_N),#总竖向力

"E\_a":self.E\_a.get\_info(), #主动土压力

"G":self.G.get\_info(), #挡墙重力

"W\_toe":self.W\_toe.get\_info(), #墙趾上土体重力

"W":self.W.get\_info(), #真实墙背与第二破裂面间土体重力

"W1":self.W1.get\_info(), #第一破裂面与第二破裂面间土体重力

"G\_p":self.G\_p.get\_info(), #挡墙地震力

"W\_p":self.W\_p.get\_info(), #真实墙背与第二破裂面间土体地震力

"W1\_p":self.W1\_p.get\_info(), #第一破裂面与第二破裂面间土体地震力

"check\_1":result\_check\_1, #组合I

"check\_4":result\_check\_4 #组合IV

}