

1、实验名称及目的

多机地形高度获取接口实验：在进行多个飞机的集群控制例子时，往往需要输入每个飞机得初始位置矩阵列表 InitPosList，RflySim 平台提供了高度信息获取接口，使得可以像 bat 启动脚本一样，给定飞机数量和间距，自动配置飞机初始摆放位置，并根据当前地形求出地形高度。本实验以 12 架飞机的高度信息获取为例进行实验步骤详解。

2、实验效果

在 MATLAB 命令行中打印出指定场景地图和给定飞机间距的初始摆放位置的地形高度。

```
>> GenSwarmPos12
Init pos and yaw lists for ***Pos.bat is :
PosXStr=0,0,0,0,2,2,2,2,4,4,4,4
PosYStr=0,2,4,6,0,2,4,6,0,2,4,6
YawStr=0,0,0,0,0,0,0,0,0,0,0,0

Alt list is
Alt=-8.0485,-7.7987,-7.4631,-7.1196,-8.2515,-7.

Init Pos and Yaw list for Python is:
InitPosList=[
    [-8.0485,0,0,0],
    [-7.7987,0,2,0],
    [-7.4631,0,4,0],
    [-7.1196,0,6,0],
    [-8.2515,2,0,0],
    [-7.7519,2,2,0],
    [-7.5333,2,4,0],
    [-7.3226,2,6,0],
    [-8.3685,4,0,0],
    [-8.1188,4,2,0],
    [-7.7831,4,4,0],
    [-7.3772,4,6,0],
]
```

3、实验原理

本实验中 LoadPngData XXX 函数加载期望的地图数据，其中，XXX 对应了 map 文件夹内的某一个地图文件。Map 文件夹中存储的 XXX.png 为地形网格文件，XXX.txt 为校准数据文件。本函数的核心是导入 png 为矩阵文件，加入校准数据，再转存为高度图矩阵。

getTerrainAltData 函数的作用是输入地图的 x, y 坐标，输出当前地形高度 z。通过该函数可以获取地形中任意位置的高度信息，从而可以创建出紧贴地表的运动轨迹。

GenSwarmPos**.m 脚本中设置了每架飞机的间距，再通过多次调用 getTerrainAltData.m 函数，从而求解出每架飞机的初始地形高度信息。

4、文件目录

文件夹/文件名称	说明
map	常用场景文件
GenSwarmPos2PC200.m	200 架飞机初始地形高度信息获取程序。
GenSwarmPos12.m	12 架飞机初始地形高度信息获取程序。
GenSwarmPos30.m	30 架飞机初始地形高度信息获取程序。
GenSwarmPos100.m	100 架飞机初始地形高度信息获取程序。
getTerrainAltData.m	高度信息获取函数

LoadPngData.m	场景文件.png 加载函数
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5、运行环境

序号	软件要求	硬件要求	
		名称	数量
1	Windows 10 及以上版本	笔记本/台式电脑 ^①	1
2	RflySim 平台免费版		
3	MATLAB 2017B 及以上		

①：推荐配置请见：<https://doc.rflysim.com/1.1InstallMethod.html>

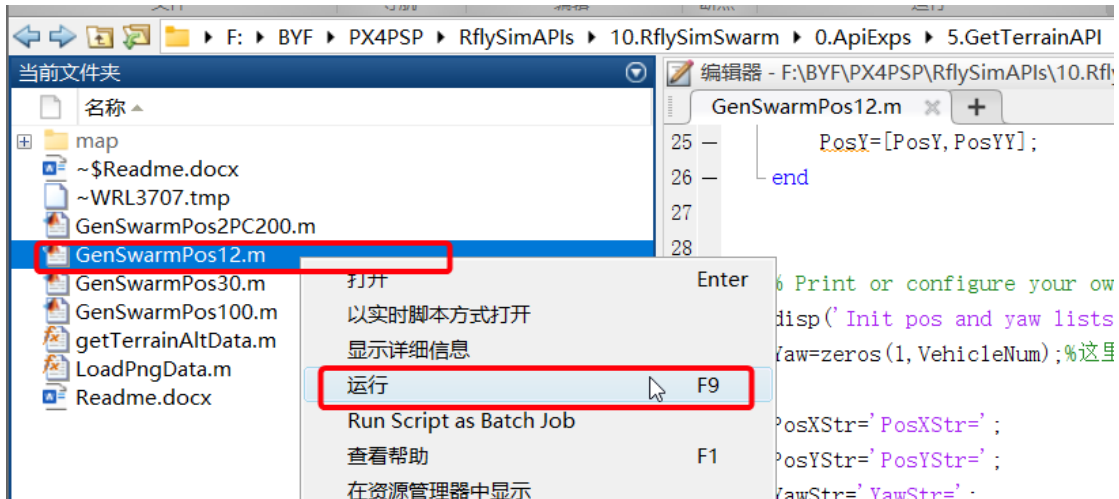
6、实验步骤

Step 1:

打开 MATLAB 软件，将 MATLAB 环境地址设置为本实验地址。

Step 2:

右击运行 GenSwarmPos12.m 文件。



即可在 MATLAB 命令行窗口中，打印出地形高度信息。如下：

```
GenSwarmPos12
Init pos and yaw lists for ***Pos.bat is :
PosXStr=0,0,0,0,2,2,2,2,4,4,4,4
PosYStr=0,2,4,6,0,2,4,6,0,2,4,6
YawStr=0,0,0,0,0,0,0,0,0,0,0,0

Alt list is
Alt=-8.1281,-7.6981,-7.1982,-6.6882,-8.2181,-7.9081,-7.4381,-6.8982,-8.2981,-8.0781,-7.7181,-7.2182

Init Pos and Yaw list for Python is:
InitPosList=[
    [-8.1281,0,0,0],
    [-7.6981,0,2,0],
    [-7.1982,0,4,0],
    [-6.6882,0,6,0],
    [-8.2181,2,0,0],
```

[-7.9081,2,2,0],
[-7.4381,2,4,0],
[-6.8982,2,6,0],
[-8.2981,4,0,0],
[-8.0781,4,2,0],
[-7.7181,4,4,0],
[-7.2182,4,6,0],

注：文件 GenSwarmPos30.m、GenSwarmPos100.m 分别是生成 30 架、100 架飞机的初始地形高度信息，与 GenSwarmPos12.m 相比仅是载具数量的变化，如下：

<pre>%% Set vehicle num info START_INDEX=1; VehicleNum=12; TOTOAL_COPTER=12;</pre>	
--	--

<pre>%% Set vehicle num info START_INDEX=1; VehicleNum=30; TOTOAL_COPTER=30;</pre>	
--	--

```
%% Set vehicle num info
START_INDEX=1;
VehicleNum=100;
TOTOAL_COPTER=100;
```

注：文件 **GenSwarmPos2PC200.m** 生成的地形高度信息则是用于在局域网内两台电脑上
进行使用，其运行之后打印出的信息如下：

[illegible]

[-7.1982,0,4,0],
[-6.6882,0,6,0],
[-6.3382,0,8,0],
[-6.1283,0,10,0],
[-5.9083,0,12,0],
[-5.5483,0,14,0],
[-5.4083,0,16,0],
[-5.3483,0,18,0],
[-5.2983,0,20,0],
[-5.2683,0,22,0],
[-5.2383,0,24,0],
[-5.2283,0,26,0],
[-5.1883,0,28,0],
[-8.2181,2,0,0],
[-7.9081,2,2,0],
[-7.4381,2,4,0],
[-6.8982,2,6,0],
[-6.4682,2,8,0],
[-6.2183,2,10,0],
[-6.1183,2,12,0],
[-5.8383,2,14,0],
[-5.5283,2,16,0],
[-5.4283,2,18,0],
[-5.3883,2,20,0],
[-5.3683,2,22,0],
[-5.3783,2,24,0],
[-5.3683,2,26,0],
[-5.3783,2,28,0],
[-8.2981,4,0,0],
[-8.0781,4,2,0],
[-7.7181,4,4,0],
[-7.2182,4,6,0],
[-6.7582,4,8,0],
[-6.4282,4,10,0],
[-6.2982,4,12,0],
[-6.0283,4,14,0],
[-5.7683,4,16,0],
[-5.4983,4,18,0],
[-5.4583,4,20,0],
[-5.4383,4,22,0],
[-5.4383,4,24,0],
[-5.4283,4,26,0],
[-5.4283,4,28,0],
[-8.4581,6,0,0],
[-8.3781,6,2,0],
[-8.0781,6,4,0],
[-7.6381,6,6,0],
[-7.2882,6,8,0],
[-6.9082,6,10,0],
[-6.6482,6,12,0],
[-6.2083,6,14,0],
[-5.8783,6,16,0],
[-5.5483,6,18,0],
[-5.5183,6,20,0],
[-5.4983,6,22,0],

```
Alt=-5.6683,-5.6483,-5.6483,-5.5583,-5.4183,-8.3681,-8.4181,-8.2981,-8.1281,-7.5981,-7.0882,-6.4082,-6.0883,-5.7983,-5.7483,-5.7183,-5.6683,-5.6583,-5.4583,-5.2083,-8.3981,-8.3881,-8.1781,-7.7781,-7.1782,-6.6382,-6.0983,-5.9183,-5.8083,-5.7883,-5.7683,-5.7083,-5.6483,-5.3583,-4.9984,-8.5081,-8.4081,-8.1181,-7.5881,-6.8982,-6.3982,-5.9883,-5.9283,-5.8383,-5.8183,-5.8183,-5.7583,-5.6683,-5.2483,-4.8184,-8.4981,-8.4081,-8.0681,-7.4681,-6.7682,-6.2583,-5.9183,-5.8683,-5.8483,-5.8383,-5.8483,-5.8083,-5.6983,-5.2483,-4.7484,-8.3781,-8.3081,-7.9781,-7.3582,-6.6782,-6.1683,-5.8883,-5.8383,-5.8283,-5.8283,-5.8483,-5.8283,-5.7383,-5.2883,-4.7684,-7.9681,-7.9381,-7.6581,-7.1082,-6.5682,-6.0983,-5.8383,-5.7783,-5.7583,-5.7583,-5.7583,-5.7383,-5.6583,-5.3383,-4.8684,-7.3982,-7.3682,-7.2382,-6.7682,-6.3582
```

Init Pos and Yaw list for Python is:

```
InitPosList=[  
    [-5.6683,12,20,0],  
    [-5.6483,12,22,0],  
    [-5.6483,12,24,0],  
    [-5.5583,12,26,0],  
    [-5.4183,12,28,0],  
    [-8.3681,14,0,0],  
    [-8.4181,14,2,0],  
    [-8.2981,14,4,0],  
    [-8.1281,14,6,0],  
    [-7.5981,14,8,0],  
    [-7.0882,14,10,0],  
    [-6.4082,14,12,0],  
    [-6.0883,14,14,0],  
    [-5.7983,14,16,0],  
    [-5.7483,14,18,0],  
    [-5.7183,14,20,0],  
    [-5.6683,14,22,0],  
    [-5.6583,14,24,0],  
    [-5.4583,14,26,0],  
    [-5.2083,14,28,0],  
    [-8.3981,16,0,0],  
    [-8.3881,16,2,0],  
    [-8.1781,16,4,0],  
    [-7.7781,16,6,0],  
    [-7.1782,16,8,0],  
    [-6.6382,16,10,0],  
    [-6.0983,16,12,0],  
    [-5.9183,16,14,0],  
    [-5.8083,16,16,0],  
    [-5.7883,16,18,0],  
    [-5.7683,16,20,0],  
    [-5.7083,16,22,0],  
    [-5.6483,16,24,0],  
    [-5.3583,16,26,0],  
    [-4.9984,16,28,0],  
    [-8.5081,18,0,0],  
    [-8.4081,18,2,0],  
    [-8.1181,18,4,0],  
    [-7.5881,18,6,0],  
    [-6.8982,18,8,0],  
    [-6.3982,18,10,0],  
    [-5.9883,18,12,0],  
    [-5.9283,18,14,0],  
    [-5.8383,18,16,0],  
    [-5.8183,18,18,0],
```

[-5.8183,18,20,0],
[-5.7583,18,22,0],
[-5.6683,18,24,0],
[-5.2483,18,26,0],
[-4.8184,18,28,0],
[-8.4981,20,0,0],
[-8.4081,20,2,0],
[-8.0681,20,4,0],
[-7.4681,20,6,0],
[-6.7682,20,8,0],
[-6.2583,20,10,0],
[-5.9183,20,12,0],
[-5.8683,20,14,0],
[-5.8483,20,16,0],
[-5.8383,20,18,0],
[-5.8483,20,20,0],
[-5.8083,20,22,0],
[-5.6983,20,24,0],
[-5.2483,20,26,0],
[-4.7484,20,28,0],
[-8.3781,22,0,0],
[-8.3081,22,2,0],
[-7.9781,22,4,0],
[-7.3582,22,6,0],
[-6.6782,22,8,0],
[-6.1683,22,10,0],
[-5.8883,22,12,0],
[-5.8383,22,14,0],
[-5.8283,22,16,0],
[-5.8283,22,18,0],
[-5.8483,22,20,0],
[-5.8283,22,22,0],
[-5.7383,22,24,0],
[-5.2883,22,26,0],
[-4.7684,22,28,0],
[-7.9681,24,0,0],
[-7.9381,24,2,0],
[-7.6581,24,4,0],
[-7.1082,24,6,0],
[-6.5682,24,8,0],
[-6.0983,24,10,0],
[-5.8383,24,12,0],
[-5.7783,24,14,0],
[-5.7583,24,16,0],
[-5.7583,24,18,0],
[-5.7583,24,20,0],
[-5.7383,24,22,0],
[-5.6583,24,24,0],
[-5.3383,24,26,0],
[-4.8684,24,28,0],
[-7.3982,26,0,0],
[-7.3682,26,2,0],
[-7.2382,26,4,0],
[-6.7682,26,6,0],
[-6.3582,26,8,0],

]

生成的两个 `InitPosList` 矩阵分别对应两台电脑上 100 架飞机的初始地形高度信息。详细实验请见：..\2.AdvExps\c12_NoPX4SITL200Swarm2PC_Py\Readme.pdf。

7、参考文献

[1]. 无。

8、常见问题

Q1: 无

A1: 无