

and +60 degree like fig. 9 but for roll, the second parameter is the angle between the quadcopter direction and 0 (forward state) and 180 (backward state) we can take another look to fig. 11 and see that the angle must be from -180 to 180 degree and the member function for it shown at fig.13.

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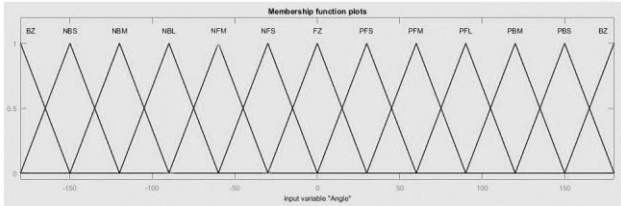


Fig. 13: Angle between quad direction and the target

The rules that applied from past roll and the angle their main goal is to make the angle zero, when the angle large the roll will be large too, the rules shown in the table. 4 below [6] where the negative value of roll means ccw rotate direction [9].

TABLE IV
 ROLL RULES TABLE FOR NEW ROLL

ANGLE ROLL	BZ	NBS	NBM	NBL	NFM	NFS	FZ	PFS	PFM	PFL	PBM	PBS	BZ
NEL	EL	VL	Z	NEL	EL	EL	EL	VL	Z	NEL	EL	EL	EL
NVL	VL	L	VS	NEL	EL	EL	VL	L	VS	NEL	EL	EL	VL
NL	L	M	S	NEL	EL	EL	L	M	S	NEL	EL	EL	L
NM	M	S	M	NEL	EL	VL	M	S	M	NEL	EL	VL	M
NS	S	NVS	M	NEL	VL	L	S	NVS	M	NEL	VL	L	S
NVS	VS	NVS	M	NEL	VL	M	VS	NVS	M	NEL	VL	M	VS
Z	Z	NVS	L	NEL	L	VS	Z	NVS	L	NEL	L	VS	Z
VS	NVS	NM	VL	NEL	M	VS	NVS	NM	VL	NEL	M	VS	NVS
S	NS	NL	VL	NEL	M	VS	NS	NL	VL	NEL	M	VS	NS
M	NM	NVL	EL	NEL	M	NS	NM	NVL	EL	NEL	M	NS	NM
L	NL	NEL	EL	NEL	S	NM	NL	NEL	EL	NEL	S	NM	NL
VL	NVL	NEL	EL	NEL	VS	NL	NVL	NEL	EL	NEL	VS	NL	NVL
EL	NEL	NEL	EL	NEL	Z	NVL	NEL	NEL	EL	NEL	Z	NVL	NEL

IV. CONCLUSION

When we produce the control commands instead the transmitter we can convert every quadcopter to auto quadcopter (drone) whatever the internal system because we can convert the new (throttle, pitch, roll) values to range between 1000 to 2000 the same range as transmitter's commands, in the other hand as above we can build the complete system. In this paper, the fuzzy control system for quadcopter airplane is proposed by computing rules between the velocity and attitude, it has high performance and reaches to accurate results.

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